Commercially Guided Visitor Use and Other Services

Environmental Assessment

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Executive Summary

This Environmental Assessment presents four sets of alternatives for the Commercial Services Plan. These alternatives respond to management issues associated with the adoption of a Commercial Services Plan for Mount Rainier National Park. They include alternatives for providing commercially guided climbs, commercially guided wilderness trips, commercially guided alpine wilderness trips and a variety of additional services, including towing, guided day hiking, guided winter activities, and shuttles.

These alternatives are presented separately and may be mixed and matched in any combination. As required by the National Environmental Policy Act (NEPA), all of the alternatives are evaluated against the current management of the services they describe (No Action), including against a 2001 baseline and projected increases that would occur when the current moratorium on new commercial services in the park is lifted.

The National Park Service preferred combination of alternatives is identified, as are the environmentally preferred alternatives. The preferred alternative combination includes: Guided Climbing Alternative 3, Guided Wilderness Alternative 3, Guided Alpine Wilderness Alternative 2, and Additional Services Alternative 2.

INTRODUCTION

Mount Rainier National Park encompasses 235,625 acres on the west side of the Cascade Range, about 65 miles southeast of Seattle and 65 miles west of Yakima. The park was established in 1899 ". . . for the benefit and enjoyment of the people. . ." Regulations within the park were enacted to "provide for the preservation from injury or spoliation of all timber, mineral deposits, natural curiosities, or wonders within said park, and their retention in their natural condition" (Mount Rainier National Park Organic Act 1899).

This Environmental Assessment is prepared to satisfy the requirements of the National Environmental Policy Act (NEPA) (1969), as amended. This Environmental Assessment also satisfies required analysis of impacts under several other federal laws, including Section 106 of the National Historic Preservation Act (NHPA), Section 7 of the Endangered Species Act, the Clean Water Act, and Clean Air Act.

NEPA requires the documentation and evaluation of potential impacts resulting from federal actions on lands under federal jurisdiction. An Environmental Assessment discloses the potential environmental consequences of implementing the proposed action and other reasonable and feasible alternatives. NEPA is also intended to provide decision- makers with sound knowledge of the environmental consequences of the alternatives available to them. In this case, the superintendent of Mount Rainier National Park and the Pacific West Regional Director are faced with a decision to adopt a commercial services plan for Mount Rainier National Park as described herein. The selected alternatives will guide the commercial services program. The commercial services plan will be reviewed annually and all changes proposed by this annual review would be preceded by environmental analysis as appropriate.

I. PURPOSE AND NEED

The purpose of this Environmental Assessment is to evaluate alternatives for proposed changes in managing Mount Rainier National Park commercial services. These alternatives establish guidelines to identify and regulate commercial services and they establish limits to minimize the effects of these commercial services on park resources.

The purpose of a Commercial Services Plan (CSP) is to provide a mechanism for establishing the types and levels of commercial activities that are necessary and/or appropriate for the park, as well as to define the most effective and efficient methods for managing the activities. It includes an evaluation process to determine appropriate new commercial services. A CSP is an implementation plan with a 5- 10 year life.

Changes to the way commercial services are managed in the park are needed to respond to 1) changes in regulations authorizing commercial services in National Parks, 2) the need to end a temporary moratorium on park commercial services, 3) goals established by the recent park General Management Plan, 4) the expiration of the contract for most guided commercial activities, and 5) the need to manage commercial use so that such use is more consistent with the park's wilderness management goals.

Regulations that apply to commercial services providers in National Parks are changing. Without a park plan to identify limits on Commercial Use Authorizations (CUAs) or (as they were formerly called) Incidental Business Permits (IBPs), these authorizations would be issued to all applicants with little ability to control numbers. In Mount Rainier National Park, beyond determining that the applicant had or could obtain the appropriate insurance, business licensing and other administrative qualifications, the only existing limits that would apply to these authorizations are the Wilderness Management Plan overnight use limits. Recognizing this, the park imposed a moratorium on all new IBPs in 1998 to avoid the potential for adverse effects on park resources from the establishment of new (and increased numbers of) commercial services.

The Mount Rainier National Park General Management Plan (2002) calls for the establishment of a commercial services plan to guide the management of park commercial services. With the completion of the GMP, modifying park commercial services to be more compatible with current management goals and objectives and ending the temporary moratorium on the establishment of new commercial services in Mount Rainier National Park were identified. Over time, services that were once identified as necessary have become readily available outside the park. Visitation, visitor needs (including the demand for commercial services), and visitor demographics have also changed. The CSP is needed to identify the management actions required to achieve the goals for commercial services identified in the GMP.

At the same time, the contract for the concessioner that provides numerous commercially guided activities in the park has expired and has been extended twice pending the completion of the GMP and the development of a park Commercial Services Plan. As a result, existing commercial activities, including guided climbing, guided wilderness use and guided alpine wilderness use could undergo changes upon issuance of a new contract. Specifically, the Commercial Services Plan evaluates alternatives for establishing new limits on existing, new and modified commercially guided overnight and day use activities, including climbing, wilderness, alpine wilderness, day hiking, commercial camping, etc.

There is also a need for park commercial use to be more compatible with park wilderness management goals, including party size limits, route marking limitations and others.

In developing the commercially guided climbing, wilderness and alpine wilderness use alternatives for the CSP, the planning team sought to offer visitors more choices in purveyors of guided activities, different types of guided experiences and different locations where guided activities were conducted. In addition to goals related to resource protection and a quality visitor experience, as noted in the plan (see *Goals for the Commercial Services Plan*) the following goals were considered common to all:

- Evaluate alternatives that offer visitors more choice both in the number of service providers and in the types of trips offered
- Allocate some commercial free time zones or areas
- Manage existing commercial services at or about the same level as currently offered
- Increase the effectiveness of park commercial service providers in providing resource protection messages to commercially guided park visitors
- Increase the safe execution of commercially guided activities on Mount Rainier
- Ensure that commercial services do not lessen or detract from the experiences of independent park visitors

Guided Climbing

The following specific goals were considered in developing the guided climbing alternatives:

- Continue to enable commercially guided climbing as both a necessary and appropriate park use.
- Decrease the potential number of guides and clients that would be able to participate in commercial activities
- Increase guided climbing on other routes identified as High Use and Moderate Use Climbing Zones (Emmons and Kautz Routes) in the GMP
- Eliminate commercial use of some sensitive areas
- Consider having more concessioner client training on route (like current IBPs)

Guided Wilderness Use

The following specific goals were considered in developing the guided wilderness use alternatives:

- Continue to enable commercially guided wilderness use as an appropriate park use.
- Avoid increasing guided wilderness use to limit impacts on the non- guided public using wilderness campsites which are already filled to capacity during peak periods
- Continue to allow commercial use of most trails and wilderness camps with some restrictions

Guided Alpine Wilderness Use

The following specific goals were considered in developing the guided alpine wilderness use alternatives:

- Continue to enable commercially guided alpine wilderness use as an appropriate park use but separate this commercial activity from guided climbing to promote more non- summit alpine experiences
- Increase educational opportunities for commercially guided alpine wilderness use
- Limit guided alpine wilderness use to existing authorized areas

Additional Services

Finally, in managing existing commercial services and in regulating new commercial services, the following additional overall goals were considered:

- Identify appropriate new commercial services activities that would increase the diversity of day use commercial services in summer and winter
- Increase commercial educational opportunities
- For towing, increase the number of commercial service providers to provide better service to visitors
- Increase the range of appropriate services to park visitors where it would not cause more impacts to park resources
- Begin to implement the GMP by allowing shuttle services on the Westside Road and parkwide
- Develop an evaluation process for new commercial services that considers impacts on park resources, park operations and visitor use

[Note: The Commercial Services Plan does not propose changes to the Guest Services, Incorporated (GSI) contract because no significant changes can be made to that contract until it expires in 2012. GSI provides food, lodging and gift services in the park.]

Planning Background

The following needs and objectives were considered in the development of the Mount Rainier National Park Commercial Services Plan:

- Soliciting public comments on the proposed development of the park commercial services plan
- Determining necessary and/or appropriate park commercial services
- Analyzing past and current commercial services management
- Identifying new commercial services from park planning documents and other sources
- Minimizing the adverse effects of commercial services on park resources
- Achieving a balance between commercial visitor use and independent visitor use
- Managing commercial services consistent with park plans, including the Mount Rainier General Management Plan (2002) and Wilderness Management Plan (1989)

Scope of this Document

Park Planning Issues

In addition to the objectives stated above, the status of the following internal planning issues related to the park GMP were considered in the development of the Commercial Services Plan:

- What relationship should there be between park independent and commercial visitor use?
- How will anticipated changes to the Wilderness Management Plan affect alternatives for managing park commercial services?
- How would the establishment of carrying capacities affect the alternatives for managing park commercial services? *(Visitor carrying capacity is the type and level of visitor use that can be accommodated while sustaining the desired resource and visitor experience conditions in the park.)*
- What early implementation strategies can be considered in the Commercial Services Plan for implementing park shuttle transportation systems as called for in the GMP?

- What is the status of existing concession contracts and other commercial services in the park and how would these be affected by the adoption of a Commercial Services Plan?
- What are the proposed changes to IBPs and CUAs and how will these affect the management of commercial services in the park?

Public and Employee Comments During Scoping

In March and April 2002, the Commercial Services Planning Team facilitated public meetings in Ashford, Tacoma, Seattle and Yakima, Washington as well as a park staff meeting in Longmire to gather comments about the future of park commercial services. Most comments concerned commercially guided climbing issues, the percentage of commercial versus independent use, and shuttle system and new commercial service opportunities.

(See *Issues Raised during Public Scoping* and *Other Significant Planning Issues* in the accompanying Commercial Services Plan document.)

Relationship to Laws, National Park Service Policy and Park Planning Documents

National Park Service management of commercial services is regulated by federal laws and their implementing regulations, National Park Service Management Policies (2001), Director's Orders, and park plans. Authority for managing commercial services in National Parks is contained in both the National Park Service and Mount Rainier National Park organic acts. Subsequent legislation has revised and extended the park boundaries, provided a headquarters near Ashford, Washington, and designated 97 percent of the park as wilderness. Finally, in 1997, most of the park's roads, buildings and structures, as well as the Wonderland and Northern Loop trails were designated as the Mount Rainier National Historic Landmark District as the best example of the implementation of National Park master planning.

National Park Service Concessions Management Improvement Act (1998) PL 105-391

The Omnibus Park Management Act of 1998 contained as Section IV guidelines for managing commercial services in National Parks and is referred to by the title listed above. This 1998 legislation superseded the thirty year old Concessions Policy Act (PL 89- 249 as amended), but reaffirmed some of the general policy of former acts, namely that:

> . . . development . . .shall be limited to those accommodation, facilities, and services that are necessary and appropriate for public use and enjoyment of the unit of the National Park System in which they are located and are consistent to the highest practicable degree with the preservation and conservation of the resources and values of the unit.

In addition, the Secretary of the Interior should ". . . exercise his authority in a manner consistent with a reasonable opportunity for the concessioner to realize a profit."

There were a number of significant changes to the old law, including changes to the:

- former preferential right of renewal for concession services,
- terms of new contracts,
- terminology used for concessions authorizing agreements,
- way money received by the park as a result of concessions could be spent.

Code of Federal Regulations

Part 5.3 requires that a business operation be under the authority of a contract, permit or other written document. Authorizations for business are made under Part 51 (for concessions) and Part 52 (for commercial use authorizations). The National Park Service has further defined the management of commercial uses in Director's Order 53: Special Park Uses.

The regulations in 36 CFR, Part 52 are new and were published as a proposed rulemaking in the Federal Register on November 27, 2002. A final rule (following the allowable public comment period) will make these regulations effective on an unknown future date.

Business operations36 CFR 5.3: Business Operations:

> "Engaging in or soliciting any business in park areas, except in accordance with the provisions of a permit, contract, or other written agreement with the United States, except as such may be specifically be authorized under special regulations applicable to a park area, is prohibited."

Regulations under 36 CFR 5.3 are used to manage incidental business permits and other special use permits. 36 CFR 5.5 permits commercial filming. Regulations in 36 CFR 1.6 permit special uses. Regulations at 36 CFR, Part 14 guide the management of rights- of- way and easements.

Management Policies (2001)

According to *Management Policies* the NPS "may permit commercial visitor services that are necessary and appropriate for public use and enjoyment of the park, and that are consistent to the highest practicable degree with the preservation and conservation of the park's resources and values. " Commercial visitor services should not be provided within a park if the needs can be adequately met outside the park. (2001:8.2.2.2)

Director's Orders and Handbooks

The following guidelines, published as Director's Orders (DO) and accompanying implementation handbooks define National Park Service management of commercial services: DO- 21: Commercial Filming, DO- 32: Cooperating Associations, DO- 48: Concessions, DO- 50: Loss Control Management Program, DO- 53: Special Park Uses (includes rights- of- way, easements, etc.), DO- 83: Public Health Management, and DO- 48A: Concession Management. These guidelines, which articulate more detailed management policies, are used along with laws and broader policies, standard contract language, and operating plans to management commercial activities throughout the National Park System.

Mount Rainier National Park General Management Plan (2002)

The General Management Plan (GMP) established a vision for managing park resources over the next twenty years. As part of this vision, the GMP established a series of zones designating desired future conditions for park resources. It also established a carrying capacity framework that, upon implementation (pending further information and analysis), will be used to establish limits for various developed and wilderness portions of the park. GMP goals and objectives related to managing commercial services include, but are not limited to:

- Protecting park natural and cultural resources unimpaired for future generations
- Restoring park resources damaged by visitors and/or ineffective management strategies
- Increasing both the amount and the effectiveness of information provided to visitors
- Dispersing visitor use away from heavily used frontcountry areas
- Decreasing resource degradation through the establishment of a carrying capacity framework (and its eventual implementation)
- Increasing park employee and visitor reliance on public transportation
- Ensuring visitor satisfaction with the availability, accessibility, diversity and quality of park facilities, services and appropriate recreational opportunities
- Encouraging gateway communities to provide services and facilities that assist visitors in enjoying and understanding park resources and values
- Stimulating visitor appreciation of park resources, values and management policies
- Fostering partnerships with individuals and groups affiliated with the park
- Using data gathered from inventory and monitoring of park resources to formulate proactive responses to park management problems

The GMP identifies the following "Guiding Management Principles and Strategies" for managing park commercial services (GMP 2002:26- 27):

- Manage businesses through concession contracts, commercial use authorizations and special use permits
- Ensure that all commercial activities in the park provide high quality visitor experiences while protecting natural, cultural and scenic resources

- Ensure that before reauthorization of commercial services occurs that the types of authorized uses are still necessary and/or appropriate, the levels of use are consistent with resource protection and quality visitor experiences, and the commercial services program can be managed in an efficient and effective manner
- Limit the expansion or development of new commercial services facilities in the park; encourage such facilities outside the park
- Prepare a commercial services plan that describes in detail the actions required to achieve commercial services and related visitor experience goals.

Wilderness Management Plan (1989)
The Wilderness Management Plan (WMP) established a system of cross- country and alpine areas across the Mount Rainier National Park landscape. At the same time, it established designated trailside camps and overnight limits on either the number of parties or number of people per camp or per zone. The limits of acceptable change established by this plan are still in effect, although over time, some have been modified slightly. (**Wilderness Management Zones Map)**. This plan is expected to be revised within the next few years.

(See also *Appendix A: Laws, Regulations and Policies* in the accompanying plan document.)

History of Commercial Services

(See *History of Commercial Services at Mount Rainier* of the accompanying Commercial Services Plan document.)

II. ALTERNATIVES

The following four sets of alternatives are proposed to guide the management of commercial services in Mount Rainier National Park. These alternatives are briefly described here and then in more detail in the accompanying plan document beginning with the section entitled *Common to All Alternatives*.

These alternatives would each offer different use limits, and a different number and array of service providers for guided climbing, guided wilderness use and guided alpine wilderness use, as described below and in the accompanying Commercial Services Plan document. They would also offer varying restrictions on commercial use in existing wilderness management areas and camps. Some would also offer differences in other factors related to conducting the particular guided activity, such as different conditions associated with weekend use and/or mountaineering day schools.

Commercially Guided Climbing Alternatives

Guided Climbing Alternative 1: No Action: Continue Current Management (Increase Use)
Although this alternative is termed "no action" under NEPA, it would actually be a continuation of current management with respect to commercial services. It is important to note, however, that with the lifting of the moratorium, there would be a dramatic difference in the way commercial services are managed now, compared to the way they would be managed under the this alternative in the future. There would be an expanded range of opportunities and increased use for commercial services in the park once the current moratorium on new commercial services was lifted. Limits on these services would come only from existing Wilderness Management Plan overnight use limits. Differences in the management of these services would come from changes to commercial services management regulations and these activities would then be managed under the new set of Commercial Use Authorization (CUA) guidelines, rather than the foregoing set of Incidental Business Permit (IBP) guidelines.

Muir and Other Routes: Guided climbing on the Muir, Kautz and Other Routes would continue to be managed under one concessioner, who could continue to guide a maximum of 59 people per

night (maximum 8,260 summer user nights), seven days a week, with 35 spaces per night reserved at Camp Muir, 12 on the Muir Snowfield and 12 at Ingraham Flats. This concessioner would also continue to guide on all Other Routes (except the Emmons) subject to competition with the public using the public reservation system for overnight spaces (there are no people or user night limits other than would occur through competition with the public). A maximum of approximately 10,080 user nights (with 5,040 people) would be available on the Kautz Route for independent and commercial use. This concessioner could also continue to use up to 36 spaces per day in a Mountaineering Day School with a minimum guide to client ratio of 1:11.

Emmons Route: Guided climbing on the Emmons Route would continue to be managed through Incidental Business Permits changed to Commercial Use Authorizations and would increase until limited by Wilderness Management Plan overnight use limits, resulting in an increased number of CUAs. Each CUA could continue to have 12 people per group and would be limited to 3- night climbs (and a portion of an estimated 10,800 summer user nights divided among CUA and independent use). No mountaineering day school opportunities would be available. All training would be done on route or outside the park. Staggered starting dates among CUAs would avoid some overlap. Friday and Saturday nights would continue to be commercial free.

Guided Climbing Alternative 2: Maintain Muir Route Use and Increase Competition and Use on Emmons, Kautz and Other Routes

In this alternative, all climbing routes (except the Comet Falls approach to the Kautz Route and Fuhrer's Finger), all camps except the Muir Snowfield, and all trails would be available for commercial use. Guided climbing would be managed through one concessioner on the Muir Route and four concessioners on the Emmons, Kautz and Other routes and would be limited to a maximum of 4,000 (4,000 user nights) on the Muir Route, 480 each (est. 1,440 user nights each) on the Emmons and Kautz Routes and 400 (est. 1,200 user nights) on Other Routes. The four Emmons concessioners could lead a greater number of trips than the current IBP holders can and could do so on the Emmons, Kautz and Other routes. All would be able to lead groups of 12 but would use staggered starts to avoid becoming one large group and/or to avoid overlap (Emmons and Kautz Routes). There would be daily climbs on the Muir Route and each concessioner on the Emmons and Kautz Routes would be able to take one group every other week. There would be a maximum of approximately 5,360 people and 8,080 user nights in this alternative.

On the Muir Route, 24 spaces would be available for a Mountaineering Day School and there would be a maximum of 36 clients and guides who could camp at Camp Muir (36) or Ingraham Flats (12).

On the Emmons Route, commercially guided groups could camp up to one night each at Glacier Basin and Inter Glacier and up to two nights at Camp Schurman or Emmons Flats. There would continue to be no commercial use on Friday and Saturday nights. No Mountaineering Day School spaces would be allocated. Training would be on route, outside the park or through the Muir concessioner.

On the Kautz Route, there would be no commercial use on Friday and Saturday nights and as with the Emmons Route, no Mountaineering Day School Spaces would be allocated.

On Other Routes, weekend use would be permitted and each Emmons concessioner could take up to five people on any route, up to 100 people per year. Training would be on route or outside the park.

Guided Climbing Alternative 3 (Preferred): Maintain, but Redistribute Muir Route Use and Increase Emmons, Kautz and Other Route Use, while Increasing Competition on all Climbing Routes and Identifying some Commercial Free Areas

In this alternative, many climbing routes (except Liberty Ridge, Sunset Amphitheatre, Sunset Ridge (including the Puyallup Glacier), Tahoma Glacier and South Mowich Glacier) and the Comet Falls approach to the Kautz Route and Fuhrer's Finger, most camps except the Muir Snowfield and Ingraham Flats, and all trails would be available for commercial use. Guided climbing would be managed through three equal concessioners, who would have equal access to

all routes, and limited to a maximum of 4,000 (4,000 user nights) on the Muir Route, 480 each (est. 1,440 user nights each) on the Emmons and Kautz Routes and 300 (est. 900 user nights) on Other Routes. In comparison to Climbing Alternative 2, a greater variety of trip lengths could be offered due to minimized group overlap. In this alternative and Alternative 4 a new commercial services opportunity would be added: Single Trip Guides. Eighteen Single Trip Guides (est. 540 user nights) not associated with concessioners or other CUA holders could apply for permits to lead guided climbs on a variety of routes subject to some restrictions. As in Alternative 2, all would be able to lead groups of 12 (except on Other Routes) and would use staggered starts. Each concessioner could conduct daily climbs on the Muir Route and climbs every third week on the Emmons and Kautz Routes. There would be a maximum of approximately 5,350 people and 8320 user nights in this alternative.

On the Muir Route, 36 spaces would be available for Mountaineering Day Schools and there would be a maximum of 36 commercially guided people per night at Camp Muir.

On the Emmons Route, commercially guided groups could camp up to one night at Glacier Basin and Inter Glacier and up to two nights at Camp Schurman and Emmons Flats. There would continue to be no commercial use on Friday and Saturday nights. No Mountaineering Day School Spaces would be allocated. Training would be on route, outside the park or through Muir- based schools within limits.

On Other Routes, weekend use would be permitted and each concessioner could take up to five people on any non- restricted route, up to 100 people each per year. Training would be on route or outside the park.

In this alternative, 18 Single Trip Guide CUAs would also be allocated to enable climbs by national and international guides to train clients on Mount Rainier. Each could guide one small group for up to 6- nights on any allowable route subject to certain restrictions.

<u>Guided Climbing Alternative 4</u>: Redistribute some Use from the Muir to the Emmons Route, while reducing Muir, Kautz and Other Route Use and Identifying some Commercial Free Areas

In this alternative, most climbing routes (except the Tahoma Glacier, Sunset Amphitheatre and Liberty Ridge) as well as the Comet Falls approach to the Kautz Route and Fuhrer's Finger, most camps, except the Muir Snowfield and Glacier Basin, and all trails would be available for commercial use. Guided climbing would be managed through one concessioner on Muir and Other Routes and one concessioner on the Emmons, Kautz and Other Routes, and would be limited to a maximum of 3,000 (est. 3,000 user nights) on the Muir Route, 560 (est. 1,680 user nights) on the Emmons Route, 240 (est. 720 user nights) on the Kautz Route and 200 (est. 600 user nights) on Other Routes. Both concessioners would be able to lead groups of 12 (except on Other Routes) and would use staggered starts to avoid overlap. Daily climbs on the Muir Route would be diminished and each concessioner would be able to offer more frequent climbs (including daily within limits) on the Emmons Route, including on Friday and Saturday nights. Eighteen Single Trip Guides (90 people and an est. 540 user nights) not associated with concessioners or other CUA holders could apply for permits to lead guided climbs on a variety of routes subject to some restrictions. There would be a maximum of approximately 4,000 people and 6,540 user nights in this alternative.

On the Muir Route, 24 spaces would be available for a Mountaineering Day School and there would be a maximum of 36 clients and guides who could camp at Camp Muir (36) or Ingraham Flats (12).

On the Emmons Route, commercially guided groups could camp at Inter Glacier, Camp Schurman or Emmons Flats. Unlike other alternatives, commercial use of the Emmons Route would include Friday and Saturday nights. No Mountaineering Day Schools spaces would be allocated. Training would be on route, outside the park or through the Muir/Other concessioner.

On the Kautz Route, there would be no commercial use on Friday and Saturday nights. Training would be on route, outside the park or through the Muir/Other concessioner.

On Other Routes, no weekend use would be permitted and each concessioner could take up to two small groups per week, up to 100 each per year.

This alternative would also include the 18 Single Trip Guides discussed above in Alternative 3.

Commercially Guided Wilderness Alternatives

Guided Wilderness Alternative 1: No Action (Increase Use)
This alternative would be similar to Guided Climbing Alternative 1 above with respect to the lifting of the moratorium and the increase in services and use. Guided Wilderness trips would continue to be managed through IBPs changing to CUAs and would increase until limited by Wilderness Management Plan Overnight Use limits.

Guided Wilderness Alternative 2: Increase Competition, Flexibility and Use
In this alternative, all trails and camps would be available for commercial use. Guided wilderness use would be managed through three CUAs and limited to a maximum of 396 people (2,520 user nights) annually. Each CUA could lead up to six groups in winter and five in summer, resulting in the greatest number of trips (and the greatest number of 14- day trips) offered. This is the only wilderness alternative that offers summer guided small group travel and camping in cross-country areas.

Guided Wilderness Alternative 3 (Preferred): Increase Competition, Maintain Use and Reduce Commercial Use Impacts on Summer Independent Use
In this alternative, all trails and camps would be available for commercial use. Guided wilderness use would be managed through five CUAs and limited to a maximum of 120 people (1,140 user nights) annually. Each CUA could lead one group in winter (14- nights) and one group in summer (5- nights). Summer cross- country use would not be permitted.

Guided Wilderness Alternative 4: Increase Competition and Flexibility and Maintain Use
In this alternative, all trails and camps would be available for commercial use; however there would be no use of Indian Bar or Summerland camps on Friday or Saturday nights. Guided wilderness use would be managed through two CUAs and limited to a maximum of 144 people annually (840 user nights). In summer, each CUA could lead up to six trips (1- 14 night trip and five 7- night trips), subject to some restrictions. Summer cross- country use would not be permitted. In winter, each CUA could lead up to three 14- night trips.

Commercially Guided Alpine Wilderness Alternatives

Guided Alpine Wilderness Alternative 1: No Action (Increase Use)
Guided alpine wilderness use would continue to be managed under one concessioner, and IBPs converted to CUAs and would expand until limited by the Wilderness Management Plan overnight use limits.

Guided Alpine Wilderness Alternative 2 (Preferred): Maintain Competition and Use
In this alternative, Alpine Paradise/Alpine Nisqually and Alpine Winthrop would be available in summer or winter. Guided alpine wilderness use would be managed through five CUAs (the fewest number among the alternatives) and limited to a maximum of four 4- night trips each. There would be a maximum of 240 people annually (960 user nights). There would be no use of Camps Muir, Schurman and Hazard.

Guided Alpine Wilderness Alternative 3: Offer a Moderate Increase in Competition and Use
In this alternative, Alpine Paradise/Alpine Nisqually and Alpine Winthrop would be available in summer or winter. Guided alpine wilderness use would be managed through eight CUAs (moderate in comparison to Alternatives 2 and 4) and limited to a maximum of three 4- night trips

each. There would be a maximum of 288 people annually (1,152 user nights), slightly higher than Alternatives 2 or 4. There would be no use of Camps Muir, Schurman and Hazard.

Guided Alpine Wilderness Alternative 4: Increase Competition and Maintain Use
In this alternative, Alpine Paradise/Alpine Nisqually and Alpine Winthrop would be available in summer or winter. Guided alpine wilderness use would be managed through ten CUAs and limited to a maximum of two 4- night trips. This alternative offers the greatest number of CUAs but the fewest number of trips. There would be a maximum of 240 people (960 user nights) annually. There would be no use of Camps Muir, Schurman and Hazard.

Additional Services Alternatives

Additional Services Alternative 1: No Action (Continue Current Management) – Increased Use and Services
In this alternative, the accompanying changes proposed by the Commercial Services Plan document would not be adopted (and "No Action" would be selected). As a result, the moratorium on new commercial services that had been in place until the completion of that plan would be lifted making it possible for a variety of increased opportunities for new commercial services and increased use. While no limits on day use have been established, overnight use limits would increase until the Wilderness Management Plan limits were met.

Additional Services Alternative 2: Adopt Commercial Services Plan, including a New Commercial Services Evaluation Process, and Identify Limits for a Wide Range of New, Existing and/or Expanded Commercial Services
This alternative would contain a suite of options for the following expanded guided day use activities, including road tours, summer day hiking, winter activities, bicycle tours, shuttles and group frontcountry camping. In addition, they would include the following new commercial services opportunities: photography and art courses, step- on guides, Westside Road bicycle tours, Westside Road shuttles, and Camp Muir winter guides. A new evaluation process for new commercial services, as well as increased towing services would also be available. There would be no changes to the Guest Services, Inc. contract until that contract expired in 2012.

Environmentally Preferred Alternative

As described in the National Environmental Policy Act, the Environmentally Preferred Alternative is the alternative that would:

- fulfill the responsibilities of each generation as trustee of the environment for succeeding generations
- ensure for all Americans, safe, healthful, productive and esthetically and culturally pleasing surroundings
- attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences
- preserve important historic, cultural and natural aspects of our natural heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice,
- achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities
- enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

In this environmental assessment, Alternative 3: Guided Climbing, Alternative 3: Guided Wilderness, Alternative 2: Guided Alpine Wilderness and Alternative 2: Additional Services have been designated as the environmentally preferred alternatives. These alternatives 5 contain the widest range of options with the greatest degree of impact avoidance, minimization and mitigation strategies to manage commercial services in Mount Rainier National Park. Like other action alternatives, these would ensure the highest quality of resource preservation and the greatest array of necessary and appropriate visitor use opportunities.

Alternatives Considered But Rejected

Eliminating Commercial Use in Wilderness

The Commercial Services Planning Team considered eliminating wilderness use as a commercial activity. Although backpacking requires fewer technical skills than climbing, limited commercial guiding is appropriate and could provide access for visitors who would probably never otherwise experience wilderness travel. These trips could provide a mechanism to encourage special groups (for example programs with an education component) to be introduced to wilderness values.

Snow play as a Commercial Activity

The General Management Plan calls for snow play at Paradise to be a supervised activity. The team considered but rejected the idea that it should be commercially supervised. The concept was dropped from detailed evaluation because it was not likely to be a financially feasible activity because the weather is inconsistent and it is unlikely that a business could provide quality visitor services under existing conditions.

Commercial-free Trails

Although each wilderness use alternative creates different commercial- free zones (cross- country areas) and commercial free times (such as weekends at some of the more popular camps), the idea of commercial free trails was considered but rejected. Independent use is already high, in proportion to commercially guided groups, on all trails, and limiting certain trails would focus repeated use on others, possibly creating new impacts.

Not Establishing Limits for Commercial Services

The moratorium on new commercial services complicated the meaning of the "no action" alternatives. The moratorium was only to remain in effect until a planning document was completed. It would have been misleading to treat the current limits in each "no action" alternatives as *status quo*. Therefore, the planning team decided to interpret all the "no action" alternatives as they would appear after the moratorium was lifted.

Commercially Operated Campgrounds

Commercially operated campgrounds were considered but rejected for the following two reasons: 1) they are not likely to be economically feasible at Mount Rainer due to weather fluctuations, variable schedules due to operating conditions and resource management concerns, and 2) if campground management were to be managed commercially, it might be managed through a procurement contract rather than a concessions contract.

Concessioner-Only Guided Non-summit Mountaineering

Alpine Wilderness Use was created to encourage businesses to offer important skills trainings, such as Alpine search and rescue. The goal of this category is to increase the number of businesses that could offer skills courses and to avoid limiting this opportunity to just concessioners. Concessioners, however, could apply for a guided Alpine Wilderness CUA if they choose. The focus on the guided mountaineering concessions contracts would continue to be the core competency – summit attempts.

Concessioner-Only Guided Day Use Activities

The same principle described above in non- summit mountaineering applies to day use activities. Concessioners could apply for other CUAs as appropriate for the provision of desired activities.

Firewood Sales

The planning team considered, but rejected removing firewood sales as an authorized activity. Because individual campfires continue to be a permitted activity in developed campgrounds, if firewood was not available in the park, it could be brought from home or purchased in gateway communities as visitors drove to park campgrounds. Because altering the arrangement of campground fire pits (as called for by the park GMP) is not within the scope of the Commercial Services Plan, a decision was made to continue providing the convenience of firewood sales at Ohanapecosh, White River and Cougar Rock, the park's three largest campgrounds. This

decision will be reviewed pending a proposal to alter the arrangement of fire pits in the campgrounds.

Establishing a Percentage of Commercial vs. Non-Commercial Use

Establishing a percentage can be done one of three ways:

1) as part of total allowable use or use limits (similar to Wilderness Management Plan)
2) as a part of total available space (number of campsites or user nights), or
3) as a fixed ratio between independent and commercial use.

Each method has problems. 1) If independent use increased, commercial use could also increase and vice versa – if independent use decreased, commercial use would also have to decrease. 2) This would result in fluctuations in allocating use from year to year, depending on weather and other factors. It is difficult to reduce use once use has risen to a given level. 3) A fixed ratio would also be subject to year to year fluctuations. Increases in independent use could result in decreasing commercial use, which would change the allocations called for in longer term contracts.

TABLE 1: MAXIMUM ALLOWABLE COMMERCIAL VISITOR USE LIMITS BY ALTERNATIVE[1]

		Alternative 1	Alternative 2	Alternative 3	Alternative 4
GUIDED CLIMBING					
Muir Route					
	# Concessions	1	1	3	1
	# People Per Year (PPY)	4,145 (actual concession 2001) 8,260 (concession summer potential) 4,758 (independent avg.)	4,000	Same as 2	3,000
	# User Nights Per Year (UNPY)	4,145 (est. concession 2001) 15,400 (Camp Muir summer potential independent & concession)* 8,260 (concession summer potential) 4,758 (est. independent)	4,000		3,000
	# Trips/year	550-688 (concession summer potential)	333		250
	# People Per Trip	12-15	12		Same as 2
Emmons Route[2]					
	# Concessions or CUAs	4 CUAs unknown (future)[3]	4 concessions	3 concessions	1
	# PPY	192 (actual IBP 2001) est. 3,600 (summer potential independent & concession)* 192 (IBP potential) 2,134 (independent avg.)	480	Same as 2	560
	# UNPY	576 (est. IBP 2001) 10,800 (summer potential independent & concession)* 6,404 (est. independent)	est. 1,440		1,680
	# Trips/year	16 (IBP)	40		46
	# People Per Trip	12 (IBP)	12		Same as 2
Kautz Route[4]					
	# Concessions or CUAs	1	4	3	I
	# PPY	41 (actual concession 2001) 5,040 (summer potential independent & concession)* 420 (independent avg.)	480		240
	# UNPY	82 (est. concession 2001) 10,080 (summer potential independent & concession) 840 (est. independent)	est. 1,440	Same as 2	720
	# Trips/year	Unknown (future)[3]	40		20
	# People Per Trip	12	Same as 1	Same as 1	Same as 1
Other Routes[2]					
	# Concessions or CUAs	1	4	3	1
	# PPY	58 (concession 2001) unknown (future)[3] 572 (independent avg.)	400	300	200
	# UNPY	174 (concession 2001) unknown (future)[3] 1,714 (est. independent)	1,200	900	600
	# Trips/year	unknown (future)[3]	80	60	40
	# People Per Trip	12	5	Same as 2	Same as 2
Single Trip Guides[2]					
	# CUAs			18	
	# PPY			90	
	# UNPY			540	
	# Trips/year	- - -	- - -	18	Same as 2

		Alternative 1	Alternative 2	Alternative 3	Alternative 4
	# People Per Trip			5	
TOTAL CLIMBING (commercial)	**PPY**	8,452 (potential plus competition with public on Muir and Other routes) (4,436 actual 2001) 8,724 (independent avg.)	5,360	5,350	4,090
	UNPY	Unknown (future commercial) 13,716 (independent avg.)	8,080	8,320	6,540
GUIDED WILDERNESS					
	# CUAs	5 IBPs 1 Concession	3	5	2
	# PPY	94 (IBP 2001) unknown (future)[3] unknown (independent avg.)	396	120	144
	# UNPY	677 (IBP 2001) unknown (future) 25,489 (est. independent 2001)	2,520	1,140	840
	# Trips/year	unknown (future)[3]	33	10	12
	# People Per Trip	5 or 12	Same as 1	12	Same as 3
GUIDED ALPINE WILDERNESS[5]					
	# CUAs	2 IBPs (2001) 1 Concession (2001) unknown (future)[3]	5	8	10
	# PPY	180 (potential IBP 2001) 1,610 (future potential)	240	288	Same as 2 (# of trips same as 3)
	# UNPY	720 (potential IBP 2001) 6,440 (summer potential independent & concession)* unknown (independent avg.)	960	1,152	
	# Trips/year	10 (2001)	20	24	
	# People Per Trip	12	Same as 1	Same as 1	
SUBTOTAL Climbing, Wilderness, Alpine Wilderness Commercial Use	**# PPY**	4,710 (2001 commercial use) unknown (future) unknown (independent avg.)	5,996	5,758	4,474
	# UNPY	4,977 (2001 commercial use) unknown (future) 50,474 (independent 2001)	11,560	10,612	8,340
ADDITIONAL SERVICES – DAY USE ACTIVITIES					
Road Tours					
	# Trips/year	- - -	10	- - -	
	# People Per Summer		3,000		
Summer Guided Day Hiking					
	# Trips/year	56 (2001) unknown (future)[3]	10	- - -	
	# People Per Summer		2,400		
Winter Guided Activities					
	# Trips/Year	89 GSI (2001) unknown (future)[3]	10	- - -	
	# People Per Winter		26,880		
Step-On Guides					
	# CUAs	- - -	10	- - -	
	# People Per Summer		54,750		
Photography and Art Courses					
	# CUAs	- - -	5	- - -	
	# People Per Summer		1,500		
Westside Road Bicycling					
	# CUAs		5		

		Alternative 1	Alternative 2	Alternative 3	Alternative 4
	# PPY	- - -	1200	- - -	
Shuttles – Parkwide					
	# CUAs	2 IBPs (2001) unknown (future)[3]	10	- - -	
	# PPY	582 (2001) unknown (future)[3]	Unknown (future)		
Shuttles – Westside Road					
	# CUAs	- - -	1 of above	- - -	
	# People Per Summer		Unknown (future)		
ADDITIONAL SERVICES – OVERNIGHT ACTIVITIES					
Muir Winter Guides					
	# CUAs	- - -	2 per week	- - -	
	# People Per Winter		768		
	# UNPY		768		
	# Trips		2 per week		
	# People Per Trip		12		
Mountain Circumnavigation					
	# CUAs	1 IBP	5	- - -	
	# PPY	12	60		
Guided Bicycling					
	# CUAs	2 (2001) unknown (future)[3]	5	- - -	
	# PPY	38 (2001) unknown (future)[3]	120		
Commercial Group Camping					
	# CUAs	4 (2001) unknown (future)[3]	10	- - -	
	# People Per Summer	291 (2001) unknown (future)[3]	Est. 2,000[6] (summer weekends) Est. 10,000 (summer weekdays)		
Weekends: Ohanapecosh Cougar Rock	**Locations**	1 site F-Sat Cougar Rock	Same as 1		
Weekdays: Ohanapecosh Cougar Rock Ipsut Creek	**Locations**	2 sites M-Th Cougar Rock 1 site Ohanapecosh	2 sites M-Th Cougar Rock 1 site each Ohanapecosh Ipsut Creek		
SUBTOTAL Additional Services	**# PPY**	1,056 (2001 commercial use) unknown (future)	102,678 (Maximum commercial use where limits have been noted for additional services)	- - -	

[1] Limits are Summer unless stated otherwise. Table does not include amount of commercial use associated with food, lodging and gift services concessioner (GSI)
--- doesn't apply
[2] Three-night trips used for user night calculation for Emmons and Other routes
[3] Calculation would require too many assumptions to be useful since if made it would be based on a high number of variables (including the projected number of commercial authorizations issued; number of spaces in wilderness alpine and cross-country areas, and designated camps; and the projected number of trips and clients).
[4] Two-night trips used for user night calculation on Kautz Route
[5] Four-night trips used for user night calculation for Alpine Guided Wilderness
[6] Based on an estimated 25 people per group site (some are smaller, some larger)
* Summer potential use equals user nights from camps normally used (user nights) or user nights divided by ordinary number of days to complete route (people per year). Emmons summer is calculated at 100 nights due to closure of White River Road.

III. IMPACT TOPICS

Specific impact topics were developed to address potential natural, cultural, recreational and park operations impacts that might result from the proposed Alternatives as identified by the public, NPS, and other agencies, and to address federal laws, regulations and orders, and NPS policy. A brief rationale for the selection of each impact topic is given below.

Air Quality: The *Clean Air Act* requires federal land managers to protect air quality, while the *NPS Management Policies* address the need to analyze air quality during park planning. Mount Rainier National Park is a mandatory Class I air quality area under the Clean Air Act. This designation allows for minimal air quality deterioration.

Soils: *Management Policies* (NPS 2001) require the NPS to understand and preserve and to prevent, to the extent possible the unnatural erosion, physical removal, or contamination of the soil.

Water Quality/Quantity: Section 401 of the *Clean Water Act*, potential impact to endangered species listed under the Endangered Species Act, as well as NPS policy requires analysis of impacts on water quality. The increased/decreased use of water to provide for public use may also have an impact on park resources, such as amphibians.

Geological Hazards: Mount Rainier has an extensive history of eruptions, ashfall, debris flows and other geologic events that have shaped the present landforms. These present an ongoing hazard to visitors and staff. The Westside Road was closed to public vehicle use in 1988 due to active recurrence of glacial outburst flooding in Tahoma Creek. *Management Policies* (2001) calls for analysis of geological hazards should they be relevant.

Vegetation and Wildlife: The *National Environmental Policy Act* (NEPA) calls for examination of the impacts on the components of affected ecosystems. NPS policy is to protect the natural abundance and diversity of park native species and communities, including avoiding, minimizing or mitigating potential impacts from proposed projects.

Special Status Species and Habitats: The *Endangered Species Act* requires an examination of impacts to all federally listed threatened or endangered species. NPS policy also requires an analysis of impacts to state- listed threatened or endangered species and federal candidate species. Under the ESA, the NPS is mandated to promote the conservation of all federal threatened and endangered species and their critical habitats within the park boundary. Management Policies includes the additional stipulation to conserve and manage species proposed for listing. Ongoing informal consultation with the U.S. Fish and Wildlife Service, National Marine Fisheries Service and Washington Department of Fish and Wildlife has identified several important rare, threatened and endangered species that occur in Mount Rainier National Park.

Archeology: Conformance with the *Archeological Resources Protection Act* in protecting known or undiscovered archeological resources is necessary.

Ethnography: Mount Rainier and the surrounding area have a long history of use by prehistoric and contemporary Native Americans. Analysis of impacts to known resources is important under the *National Historic Preservation Act* and other laws.

Historic Structures: Five architecturally significant historic districts were designated in Mount Rainier National Park prior to the comprehensive NHLD. Although the historic districts are enveloped by the NHLD, they remain separately listed on the *National Register of Historic Places* for their architectural significance. As stated above, impacts to cultural resources must be considered under both law and NPS policy.

Cultural Landscapes: In 1997, much of the non- wilderness portion of Mount Rainier National Park was enveloped in the then designated Mount Rainier National Historic Landmark District. The District was designated because the park is the best and most intact example of NPS master

planning dating from the early 20th century. In addition to developed area structures, the Wonderland and Northern Loop trails are also part of the NHLD. Consideration of the impacts to cultural resources is required under provisions of Section 106 of the *National Historic Preservation Act of 1966*, as amended, and the 1995 *Programmatic agreement among the National Park Service, the National Conference of State Historic Preservation Officers, and the Advisory Council on Historic Preservation*. It is also required under *Management Policies* (2001).

Visitor use: Dependent on the selected alternative, a variety of impacts to visitor use may occur. Based on *Management Policies* (2001), impacts to visitors are considered with respect to park undertakings.

Wilderness: Ninety- seven percent of Mount Rainier National Park is designated wilderness. *The Wilderness Act* requires an examination of proposed projects for their potential impacts to wilderness character and values. Projects that may affect wilderness are reviewed for their necessity with respect to administration of wilderness, their consistency with wilderness designation, as well as with respect to the use of the minimum tool. A discussion of the minimum tool is found in Appendix 2 of this document.

Park Operations and Visitor Services: Impacts to park operations and visitor services are often considered in Environmental Assessments. Impacts to the park visitor experience are particularly important to describe.

Socioeconomic Environment: Analysis of the socioeconomic impacts of park commercial use may be important to surrounding gateway communities.

IMPACT TOPICS DISMISSED FROM FURTHER CONSIDERATION

Other impact topics mandated by law or executive order, or that are of public interest, have been dismissed from further consideration because no impacts would occur. These include the following:

Environmental Justice: Executive Order 12898 requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing disproportionately high and adverse human health or environmental effects of their programs and policies on minorities and low- income populations and communities. This Executive Order does not apply to the subject of this Environmental Assessment.

Floodplains: Executive Order 11988 requires that impacts to floodplains be addressed. No floodplains would be affected by actions proposed in this Environmental Assessment.

Water Quantity: Although water is used by wilderness visitors for subsistence purposes and by the current climbing concessioner to provide water to clients at Camp Muir, such water use is not significant and is minimal compared to water provided for general visitor use. Changes to water use are not proposed as part of this plan and do not constitute a significant aspect of managing commercial services in Mount Rainier National Park.

Wetlands: Executive Order 11990 requires that impacts to wetlands be addressed. No wetlands would be affected by actions proposed in this Environmental Assessment.

IV. AFFECTED ENVIRONMENT

Mount Rainier National Park is comprised of 235,625 acres in west central Washington, on the western slope of the Cascade Range. Eighty three percent (196,181 acres) of the park lies in Pierce County and 17 percent (39,444 acres) is in Lewis County. The elevations of the park range from about 1,400 feet above sea level at the Tahoma Woods Administrative Site to 14,410 feet at the summit of Mount Rainier.

The focal point of the park is the towering, snow and ice- covered volcano, a prominent landmark in the Pacific Northwest. The base of the volcano spreads over an area of about 100 square miles. Mount Rainier is the second most seismically active and most hazardous volcano in the Cascade Range. The 26 major glaciers that flank the upper mountain cover 35 square miles. Below, steep glaciated valleys and ice carved peaks dominate the park landscape. The Carbon, Mowich, White, West Fork White, Nisqually, South Puyallup, and North Puyallup rivers and their tributaries carry water from Mount Rainier to the Puget Sound. The Ohanapecosh flows into the Cowlitz River before exiting the park enroute to the Columbia River.

Mount Rainier's scenic landscapes – including the dense lower old- growth forests, the magnificent display of subalpine wildflowers, mantling the Mountain itself – have attracted people for generations. The mountain is a destination for snow and ice climbers throughout the world. About 2.0 million people visit the park annually, with most visitation (75 percent) occurring between June and September.

➢ AIR QUALITY

Mount Rainier National Park is in a mandatory Class I area under the Clean Air Act (1977). Class I areas are afforded the highest degree of protection under the Clean Air Act. This designation allows very little additional deterioration of air quality. The Clean Air Act states that park managers have an affirmative responsibility to protect park air quality related values (including visibility (scenic vistas), plants, animals, soils, water quality, cultural resources and visitor health) from adverse air pollution impacts. Special visibility protection provisions of the Clean Air Act also apply to Class I areas, including new national rules to prevent and remedy regional haze. Under existing visibility protection regulations, the NPS has identified "integral vistas" as important to the visitor's visual experience in NPS class I areas, and it is NPS policy to protect these scenic views, however none have been designated in the park. National Ambient Air Quality Standards (NAAQS) must also be met.

Any impacts to air quality, therefore, are considered potentially detrimental. In contrast to surrounding metropolitan areas, air quality within the park is usually good; however, high ambient sulfate levels, low pH levels of airborne water droplets, and high ozone levels have all been documented. Campfires, generators, heating systems and the operation of motor vehicles and equipment all may cause local, temporary air quality degradation. Because urban areas in King, Pierce, Lewis and Yakima counties surround the park stationary and mobile emissions in the region are the major sources of air pollution near the park. These include industrial developments, power plants, logging, slash burning, pulp and paper mills, etc. Air quality related values, such as visibility and scenic vistas are occasionally affected by non- attainment particulate concentrations in surrounding areas.

RMI and IBPs are currently required to shuttle their employees and clients within the park. GSI is required to shuttle its non- resident employees within the park on the Nisqually to Paradise Road. In summer, three park employee shuttle vans are available between Eatonville and Longmire and are generally filled in summer. In winter, one van is available between Eatonville and Longmire and offers consistent service to a limited number of employees. GSI guests are not required to use shuttles.

The recently completed GMP proposes centralized campfires over time but does not specify the configuration (per adjacent sites, per loop, etc.). No current proposals for campground rehabilitation have yet addressed centralized campfires. Wood stoves have, over time, been eliminated from most park residences, but are still maintained in historic buildings (including the National Park Inn, Paradise Inn, Longmire Community Building, Sunrise Visitor Center, and patrol cabins) and other settings (campsites and campground amphitheatres) as appropriate visitor activities. Fire rings are available at all developed campgrounds (Ipsut Creek, Sunshine Point, Cougar Rock, Ohanapecosh and White River). Firewood sales are available at Cougar Rock, Ohanapecosh and White River. No campfires are allowed within designated wilderness or

backcountry camps. A large percentage of park fuel use for heating and motor vehicles has been converted from diesel to bio- diesel and from wood- stoves or electric wall units to propane units. Propane tanks at Camp Muir and Camp Schurman currently supply cook stoves at both locations and a snow melt potable water system at Camp Muir. Conversion from diesel generator to solar power is ongoing as appropriate given solar exposure and resource impacts.

➢ SOILS

The park contains areas of high elevation solid rock and talus slopes with virtually no soil to low elevation glacial valleys with well- developed organic soils. Hobson (1976) classified park soils into four types as follows: tephra soils (pyroclastic deposits identified by individual ash layers); colluvial soils (coarse, unconsolidated soils of mixed parent materials); alluvial soils (river or glacially deposited soils); and mudflow soils (surface or subsurface parent materials resulting from volcanic mudflows). Beyond the work done by Hobson, however, there is little information on park soils, although Franklin *et al*. (1988) described more soil information.

Tephra soils are common in forest communities and are comprised of volcanic parent materials (ash, pumice, etc.). They are typically coarse sands or gravelly sandy loams with less than 10 percent organic material.

Colluvial soils are the dominant soil group in the park (Franklin *et al*. 1988). They are generally unstable, rapidly drained and consist of coarse, unconsolidated mixed parent materials. They are found on slopes at all elevations, but especially on steeper slopes and south facing aspects.

Alluvial soils occur in major river valleys, along streams, wet benches and alluvial slopes and fans. They consist of coarse undifferentiated fine or very fine sands. Alluvial deposits are of varying thickness and texture.

Mudflow soils result from lahars (volcanic debris flows). They are characterized by poorly sorted materials and often include rounded rocks and boulders intermixed with fine loamy sands, cobbles and gravel.

➢ WATER QUALITY

Mount Rainier is "the place where the rivers begin" in the Puget Sound and beyond. Park water resources are diverse and include alpine lakes, waterfalls, glacially fed rivers and mineral springs. Nine major rivers as well as numerous significant creeks flank the mountain. Park rivers, lakes, streams and other wetlands are abundant. With very few exceptions, park rivers and streams originate within the park. (Exceptions include some portions of the Huckleberry Creek Watershed, Chenuis Creek Watershed and Nisqually River watershed.) The National Wetlands Inventory mapped at least 2,321 wetlands covering 3,200 acres.

Physical, chemical and biological data is available for many lakes, streams and wetlands. Data include water and air temperature, aquatic biota (fish, amphibians, invertebrates), conductivity, dissolved oxygen, pH, turbidity, alkalinity, suspended solids, dissolved solids, total nitrogen (including nitrate, nitrite, and ammonia), total phosphorus and orthophosphate, silica, sodium, potassium, calcium, chloride, sulfate, and magnesium. In addition, there is information on size, perimeter, elevation, wetland delineation, and stream order. Flow and discharge information is significantly lacking. No gauging stations are located within the park.

Park water quality within most park rivers would meet Class AA water standards according to data collected at the Nisqually River station near Longmire (Samora 1998). Class AA waters are characterized by exceptional water quality and are designated under the state administration of the Clean Water Act. Park waters are currently being considered for listing as Outstanding Natural Resource Waters under the Antidegradation Policy of the Clean Water Act.

Some park waters may be impacted by park operations, including wastewater treatment plants (Paradise River, Nisqually River, Ohanapecosh River – although the latter two discharge to groundwater); septic systems (White River, Carbon River, Sunrise, etc.); stormwater and snowmelt runoff from roads; and developed areas (Nisqually River, Paradise River, Ohanapecosh River, White River, Carbon River) in addition to natural erosion from hillsides.

Human Waste and Water Quality -- Climbing

To mitigate the impacts of visitors on water quality in high elevation areas in Mount Rainier National Park, comfort stations were constructed at Panorama Point in 1929 and at Camp Muir in the mid- 1930s. Since then, there have been a variety of toilets on the upper mountain. Current upper mountain toilets include:

- a portable toilet at Panorama Point (to be replaced with a solar toilet within the historic comfort station),
- two pit and three solar toilets at Camp Muir and
- a solar toilet at Camp Schurman.

Although the toilets at Camps Muir and Schurman have been working well since installed, there is still no effective way to dispose of liquid waste. Although it is removed to a "leach field" the effectiveness of the leaching process is considered inadequate. As a result this is one of the key issues in the Camp Muir Development Concept Plan process (see Cultural Resources section below). A test system of evaporators is planned for summer 2003 at Camp Muir.

Before 1982, when the park's High Altitude Human Waste Removal Program was implemented, high altitude sanitation and human waste disposal was one of the three most significant threats to the park (Resource Management Plan 1982). During this time, human waste was accumulating on high altitude routes in the park due to poor or inadequate waste disposal facilities. To better manage human waste, the park initiated an aggressive public education program, clean up patrols, research on water contamination, new technology, and a "pack it out" program. The overall objectives of the program were to reduce the volume of waste, maximize its decomposition, and to minimize water contamination and discovery by others.

Beginning in 1982, human waste began to be centrally collected on the upper mountain and for a year, crevasse disposal was used. From 1983 on, however, the practice of *pack it in, pack it out* through "blue bags" was initiated. Climbers and winter wilderness hikers were then and are now are provided with blue bags to deposit their wastes in. Blue bag receptacles (55- gallon drums) have been placed throughout the park along well- used routes. Year- round blue bag barrels are located at "the Fan," below Camp Hazard, Camp Muir, Camp Schurman and Paradise. Summer blue bag barrels are located at White River Campground, White River Ranger Station, Longmire, and Westside Road at Tahoma Creek Trailhead, Ipsut Creek Campground, Mowich Lake, Ingraham Flats, and Emmons Flats.

Non- wilderness barrels are removed via helicopter in autumn and the waste incinerated in Tacoma. The contents of wilderness barrels are periodically carried out (down the mountain) by park staff. In 1989, approximately 15 barrels [6,000 lbs**] of waste comprising (about 621 gallons) and two barrels [800 lbs**] of blue bags were removed from Camp Muir. In 1989 approximately 82 gallons [600 lbs**} of waste were removed from the pit toilet and two drums [600 lbs**} of blue bags from Camp Schurman and Emmons Flats. In 1996, approximately 1,100 pounds was removed from the Emmons Route. There were approximately 200 lbs. from blue bags (50 lbs. from Camp Schurman and 150 lbs. from Emmons Flats). The remainder (900 lbs) was from the toilet at Camp Schurman. This removal resulted in approximately 8 flights (4 each from Camp Schurman and Emmons Flats). In 2002, approximately twenty- eight barrels of human waste, comprising five and a half tons (11,000 lbs) were removed from the park (Climbing Cost Recovery Report 2002). From 1989 to 2002, there was a 37 percent increase in human waste removal from the upper mountain (from 8,000 to 11,000 lbs). Over about this same time, there was an increase in climbers parkwide from an estimated 7,534 climbers in 1989 to an estimated 11,688 climbers in 2001 people (or an increase of approximately 4,154 people).

** estimated weight of one barrel 400 lbs

Human Waste and Water Quality: Other Wilderness Use

To mitigate the same problem (inadequate or improper human waste disposal in other park backcountry and wilderness) there are currently approximately 37 designated wilderness camps, each containing one or more pit, vault or composting toilets (group sites often have a second toilet) and varying numbers of individual and group sites. Until the Backcountry Management Plan in 1973, wilderness camps, with few exceptions, were undesignated. As a result, there were a wide range of impacts, ranging from inadequate or improper human waste disposal to increasing bare ground area associated with frequently used camp sites in popular areas. Following acknowledgement of increasing use and impacts throughout park wilderness as a result of increasing numbers of backpackers in the 1970s, wilderness camps were designated using the 1973 Backcountry Management Plan. The Wilderness Management Plan (1989), including its subsequent revisions, continued to result in refinement of designated camps and campsites. For instance, in the late 1980s ongoing impacts to subalpine areas resulted in removing most designated wilderness camps from subalpine areas to forested areas. The Wilderness Management Plan also set allowable use limits within designated zones or areas for much of the park. A recent study (Human Waste Management in Backcountry Areas of Mount Rainier National Park) that assessed wilderness camp toilet locations for their water quality impacts has continued to result in further refinement of wilderness camps since that time, especially identification of the most appropriate location and type of toilet for each camp (Jetton et al. 1995):.

Human waste management in other parts of Mount Rainier wilderness continues to be managed via minimum impact techniques communicated to park wilderness visitors. In winter, and in upper elevations, as mentioned above, blue bag use is encouraged or required. Winter camping regulations at Paradise require large groups to use the restrooms or to use blue bags. Smaller groups located more distant are required to use blue bags.

➢ GEOLOGICAL HAZARDS

Mount Rainier has an extensive geologic record of activity, including lava flows, ash eruptions, avalanches, mudflows and glacial outburst floods. The threat of mudflows is particularly acute due to the "rotten" array of sediments altered by heated magma within the volcano and the presence of an extensive glacial ice cap.

Earthquakes, although they may be associated with periodic volcanic activity, are also a threat in and of themselves. Mount Rainier last erupted approximately 150 years ago (ash and steam) and 1000- 2000 years ago (lava). Since that time numerous large floods and debris flows have been generated on its slopes (National Academy of Sciences, 1994). The National Academy of Sciences (1994) has stated that "volcanic hazards or volcano related events that are likely to pose threats to persons or property include the following:

- Volcanic eruptions: The eruption of ash flows and tephra (ash or pumice).
- Edifice failure: The gravitational collapse of a portion of the volcano.
- Glacial outburst floods: The sudden release of melt water from glaciers and snow pack or from glacier dammed lakes on the edifice.
- Lahars or debris flows, and debris avalanches: Gravitational movement of commonly water-saturated volcanic debris down the steep slopes of the volcano and into nearby valleys."

Debris flows, in terms of the potential effects and probability of occurrence, constitute the greatest volcanic hazard in the Cascade Range (Hoblitt et al. 1995). Debris flows consist of slurries of water and sediment (60 percent or more by volume) that look and behave much like flowing concrete. Debris flows are sometimes called mudflows or, when they originate on volcanoes, lahars (Hoblitt et al. 1995).

➢ VEGETATION

Park vegetation is diverse, encompassing three ecological zones: the alpine zone, the subalpine zone and the forest zone.

❖ Forest Zone

The forest zone blankets the lower elevations of the Mountain's flanks, occupying about 58 percent of the park, and is dominated by the following evergreen trees: western hemlock (*Tsuga heterophylla*), Douglas- fir (*Pseudotsuga menziesii*), western red cedar (*Thuja plicata*), Pacific silver fir (*Abies amabilis*), mountain hemlock (*Tsuga mertensiana*), Noble fir (*Abies procera*), grand fir (*Abies grandis*), subalpine fir (*Abies lasiocarpa*) Alaska yellow cedar (*Chamaecyparis nootkatensis*), Engelmann spruce (*Picea engelmannii*), western white pine (*Pinus albicaulis*), and lodgepole pine (*Pinus contorta*). Deciduous trees include: bigleaf maple (*Acer macrophyllum*), red alder (*Alnus rubra*), black cottonwood (*Populus balsamifera*), etc.

Common forest plants include: salal (*Gaultheria shallon*), seven species of huckleberry (*Vaccinium* sp.), white- flowered rhododendron (*Rhododendron albiflorum*), kinnikinnick (*Arctostaphylos uva- ursi*), twinflower (*Linnaea borealis*), Indian- plum (*Oemleria cerasiformis*), salmonberry (*Rubus spectabilis*), thimbleberry (*Rubus parviflorus*), five- leaved bramble (*Rubus pedatus*), dwarf bramble (*Rubus lasiococcus*), devil's club (*Oplopanax horridus*), red- flowering currant (*Ribes sanguineum*), sitka willow (*Salix sitchensis*), cascara (*Rhamnus purshiana*), Sitka alder (*Alnus crispa*), beaked hazelnut (*Corylus cornuta*), vine maple (*Acer circinatum*), oregon grape (*Mahonia nervosa*), false solomon's seal (*Smilacina racemosa*), false lily of the valley (*Malanthemum dilatatum*), queen's cup (*Clintonia uniflora*), bear grass (*Xerophyllum tenax*), western coralroot (*Corallorhiza maculata*), foamflower (*Tiarella trifoliata*), yellow wood violet (*Viola glabella*), white- veined wintergreen (*Pyrola picta*), pipsissewa (*Chimaphila umbellata*), vanilla leaf (*Achlys triphylla*), inside- out flower (*Vancouveria hexandra*), redwood sorrel (*Oxalis oregana*), wild ginger (*Asarum caudatum*), bunchberry dogwood (*Cornus canadensis*), skunk cabbage (*Lysichiton americanum*), sword fern (*Polystichum munitum*), deer fern (*Blechnum spicant*), and lady fern (*Athyrium filix- femina*).

❖ Subalpine Zone

From about 5,000 feet to tree line and covering about 23 percent of the park is the subalpine zone, characterized by scattered stands of subalpine fir, heather and herbaceous meadows. Park subalpine meadows are well known for their beauty and diversity. These meadows can be divided into the following types: heather- huckleberry, black sedge, green fescue, lush herbaceous and "rawmark" or early successional. The distribution patterns of these plant communities are largely determined by the depth and duration of snowpack (Franklin *et al.* 1988).

Common subalpine plants include: white mountain heather, pink mountain heather, red mountain heather (*Phyllodoce glanduliflora*), kinnikinnick, sitka mountain ash (*Sorbus sitchensis*), false azalea (*Menziesii ferruginea*), false hellebore (*Veratrum viride*), avalanche lily (*Erythronium montanum*), Tolmie's saxifrage, Newberry's fleeceflower (*Polygonum newberryi*), bistort (*Polygonum bistortoides*), spreading phlox , western anemone (*Anemone occidentalis*), louseworts (*Pedicularis* sp.), cinquefoil (Potentilla flabellifolia), rosy spirea (*Spirea rosea*), marsh marigold (*Caltha biflora*), gentians, orange agoseris (*Agoseris glauca*), subalpine daisy (*Erigeron peregrinus*), alpine aster (*Aster alpigenus*), alpine pussytoes (*Antennaria alpina*), sitka valerian (*Valerian sitchensis*), green fescue (*Festuca viridula*), black sedge (*Carex nigracans*), showy sedge (*Carex spectabilis*), wood rushes (*Luzula* sp.), spike trisetum (*Trisetum spicatum*), oat grass (*Danthonia intermedia*), mountain hairgrass (*Deschampsia atropurpurea*).

❖ Alpine Zone

Above tree line and comprising approximately 19 percent of the park is the alpine zone, generally consisting of snow, ice, rock and fragile alpine plants. The elevational range of the alpine zone on Mount Rainier is greater than any other zone in the Pacific Northwest (Edwards 1977). Alpine areas are subject to the harshest growing conditions in the park, with a limited snow- free season,

temperature extremes, water runoff during snowmelt, drying winds that sometimes result in drought conditions, etc.

Edwards (1977) characterized the alpine zone by the following plant community types: talus, fellfields, heath- sedge turf, and snowbeds. Edwards also identified plants characteristic of each community that could be used as indicators (1977:26). These communities differ in plant composition; physical characteristics such as slope, substrate and soil development, and in how long snow persists. Talus areas have steep slopes with differently sized unstable angular rock. This unstable environment is also characterized by little soil development. Fellfields are restricted in elevation and geographic distribution, occurring on less steep slopes and ridge tops. In fellfields, cobble- sized rocks are spread out over a gravel and sand substrate. Plants grow adjacent to stones and are separated by a "tight mosaic of gravel" that fits between the larger stones and prevents erosion and frost- heaving of the soil below (Edwards 1985:22). Stony, coarse, well- drained soil is present, but lacks accumulation of organic matter. Fellfields contain approximately 42 plant species of which 20 do not occur below 7,000 feet and 30 only grow in the Pacific Northwest (Edwards 1985:21). Heath- sedge turf includes a range of slopes and develops in the presence of greater soil accumulation. Many different plants cover a broader area. Lichens and mosses stabilize the soil surface, forming a crust that prevents rapid runoff and needle ice formation. Snowbeds remain covered by snow until much later than the other communities. They occur on level or low slope areas, are found on pumice sandy- gravel areas and characterized by little soil development and the least species diversity.

Characteristic alpine plants include: Talus: golden draba (*Draba aureola*), mountain sorrel (*Oxyria digyna*), and dwarf mountain butterweed (*Senecio fremontii*). Fellfields: Brewer's sedge (*Carex breweri*), Dunhead sedge (*Carex phaeocephala*), spreading phlox (*Phlox diffusa*), golden fleabane (*Erigeron aureus*), Davidson's penstemon (*Penstemon davidsonii*), Tolmei's penstemon (*Penstemon tolmei*), lance- fruited draba (*Draba lonchocarpa*), and spikelike goldenrod (*Solidago spathulata*). Heath- Sedge Turf: white mountain heather (*Cassiope mertensiana*), Alaskan mountain heather (*Cassiope stelleriana*), pink mountain heather (*Phyllodoce empetriformis*), thread moss (*Pohlia* species), alpine willowherb (*Epilobium alpinum*), alpine wintergreen (*Gaultheria humifusa*), western bog- laurel (*Kalmia polifolia*), mountain bog gentian (*Gentiana calycosa*), alpine speedwell (*Veronica wormskjoldii*), and Cascade huckleberry (*Vaccinium deliciosum*). Snowbeds: alpine buckwheat (*Eriogonum pyrolifolium*) and pussy paws (*Spraguea umbellata*).

Edwards (1980:4 and 41) identified the following characteristics which make the alpine communities of Mount Rainier unique:

- 117 species of which 87 grow only in western North America, 31 only in Pacific Northwest and 26 only above 8,000 feet
- many (29) rare species and two endemic species
- recent volcanic origin compared to other Cascades peaks
- no other Washington peak offers such high elevation habitats
- wide elevational range of alpine zone provides habitat for more than 100 species and several alpine community types
- no comparable alpine area is accessible for study or visitation from metropolitan Puget Sound.

Characterization of Major Climbing Routes

Edwards (1980) also identified unique characteristics of the primary climbing routes. Muir Route: Sedge- turf terraces on the Muir Route are found nowhere else on the Mountain and the Panorama Point- Moon Rocks fellfields comprise a special and extensive plant community. On the Muir Route, Cathedral Rocks marks the highest elevation for flowering plants.

Emmons Route: Edwards (1977b, 1980) identified the significance of the Mount Ruth and Wedge areas as having more varied communities and more plant species than any other alpine area in the park. A series of unique fellfield terraces (bands of vegetation alternating with stripes of bare sandy soil overlain by pumice mulch) occur at about 7,000 feet near the main ridge.

On the Kautz Route, Edwards (1980) found the scarcity of alpine vegetation above Van Trump Park on generally barren moraines little affected by the climbing route.

Other Routes:
- Success Cleaver/Pyramid Peak fellfields may be likened to what Panorama Point must have looked like before it experienced severe usage;
- Puyallup Cleaver contains mature heather meadows, though less extensive and lower in elevation than Muir or Mount Ruth
- Ptarmigan Ridge is like an alpine desert, with sparse vegetation well protected by an obvious route (Edwards 1980).

Ongoing study of Mount Rainier's unique high elevation alpine environments resulted in additional characterization of those environments. Edwards (1980) summarized her findings by noting that:
- plant species are distributed along moraines and cleavers and fragmented into subpopulations separated by glaciers and snowfields, and that
- the topography, elevational range and aspect of each cleaver are unique, resulting in corresponding differences in the number, extent and variety of plant communities.

Notably, the two areas that support the most varied communities (including substrate and species diversity) are also the two most easily accessible and frequented by climbers – the Muir Route and the Emmons Route. Edwards states that "None of the remaining approach routes, confined as they are to steeper, narrower ridges, pass through areas of great floristic density, extent or diversity such as are found on the Muir and Schurman routes." And, "It is probably not a coincidence that the less steep and easier routes favored by visitors are also favorable to many more plant species" (Edwards 1980:32).

Understanding Human Impacts to Vegetation

A great deal of study at Mount Rainier National Park has occurred regarding human impacts to vegetation and soils. Over time, a variety of methods have been used to evaluate human impacts, primarily in subalpine and alpine areas.

As early as 1977, a report summarizing human impacts along the Muir Route rated study sites into five condition classes, from "0" no impacts to "4" vegetation destroyed, erosion (Edwards 1977).

TABLE 2: MUIR ROUTE HUMAN IMPACT CLASSIFICATION

Environment	Impact Class 0	Impact Class 1	Impact Class 2	Impact Class 3	Impact Class 4
Talus (12 sites)	2	5	1	4	0
Fellfield (17 sites)	1	1	6	7	2
Heath Sedge 13 sites	4	3	3	1	2
Snowbed 4 sites	0	2	2	0	0

Edwards (1977:51- 53 and 1980:22- 25) also characterized human impacts by noting the behavior and characteristic use patterns of various visitor groups on the Muir Route between Panorama Point and Cathedral Rocks (See Appendix 1).

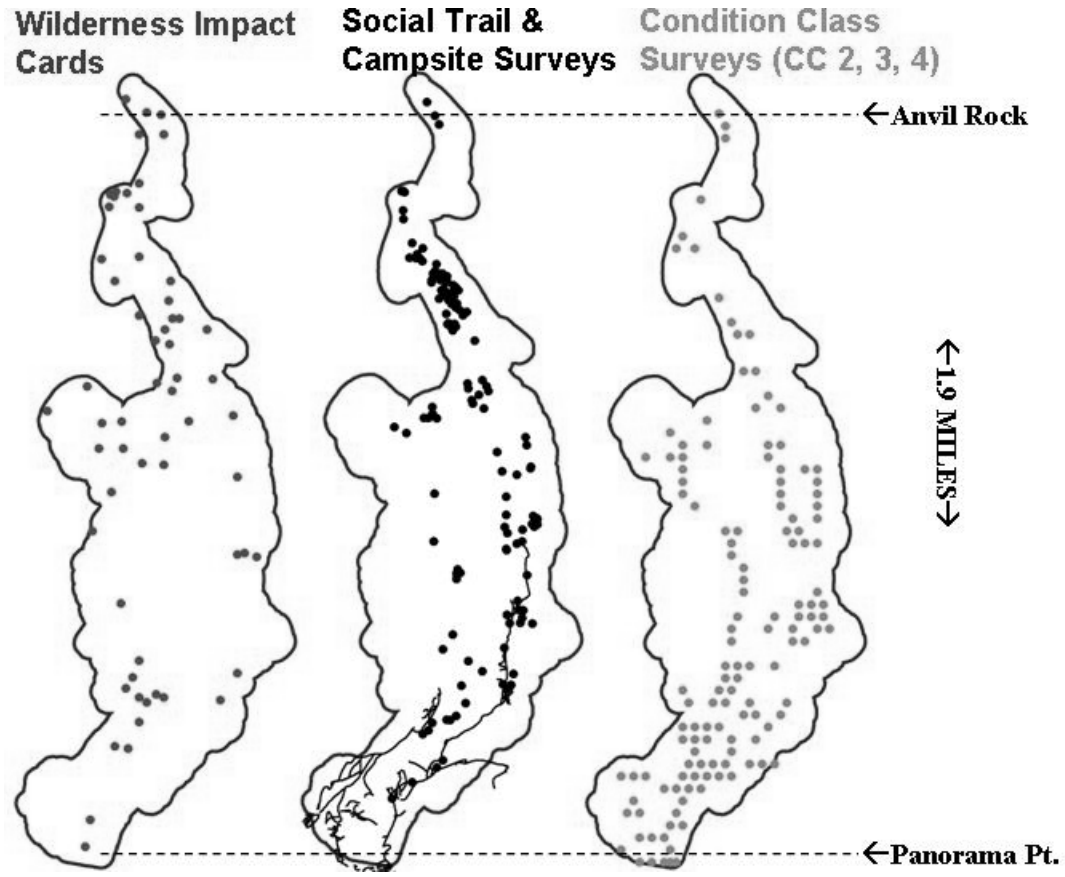
More recent studies include a three- pronged approach: 1) use of wilderness impact monitoring cards, 2) social and campsite surveys, and 3) condition class surveys. Wilderness Impact Monitoring Cards are used to allow field staff to record point impacts, such as litter, feces and illegal campsites as well as for documenting personal encounters. According to Swinney and Rochefort (1998), social trail and campsite surveys provide good quantitative descriptions of

impacts, including useful data for planning restoration. Condition class surveys have the broadest application in describing damage to park resources, are a quick method of collecting information and facilitate future relocation for additional monitoring.

Systematic condition class surveys of social trails and campsites were initiated in the 1980s. Physical measurements encompassing length, width and depth were recorded and compared to physical characteristics such as vegetation type, slope and aspect. Based on analysis of these characteristics, a series of five condition classes were established, varying from 1) pristine, 2) little change, 3) significant change, 4) severe change, to 5) habitat destroyed. To facilitate random analysis, a series of 336 0.1 acre plots were established on a grid pattern along the Muir Route (Muir Corridor).

As shown below, a summary of Muir Corridor impacts between 1989 and 1994 identified ongoing human impacts in the 425- acre study area between Panorama Point and Anvil Rocks. In 1998, 43 impact cards were received, primarily indicating litter (25 cards) and illegal camps (11 cards). Other impacts included feces, vegetation damage and no permit. Campsites were mapped and then obliterated in 1989 (estimated 80+), in 1995 (estimated 18) and 1997 (estimated 37). Social trails were mapped and obliterated in 1990 and 1997. A systematic grid system was used to characterize impacts (condition class surveys) across the corridor (See *Appendix 1* for definitions). Although most areas were in pristine condition, or showed minimal impacts, 135 sites (nearly 40%) were significantly or severely damaged or completely destroyed. Most of the severest impacts are found in the vicinity of Panorama Point, McClure Rock and Pebble Creek. Together these three methods identified over 270 impacts between 1990 and 1998. During this time, annual climbing visits varied between 7,449 and 10,863 people per year and overnight visits in the Muir Corridor varied between an estimated 350 and just over 600 people. Visitation to the snowfield area was then estimated to be 50 to 144 people per hour (Vande Kamp *et al.* 1997).

FIGURE 1: LOCATIONS OF IMPACTS FOUND USING THREE METHODS IN MUIR CORRIDOR



Why Do Human Impacts Occur? How Should They Be Avoided?

A series of visitor use studies in Mount Rainier National Park have been devoted to understanding why human impacts occur and how to avoid or minimize them. Edwards (1980) concluded in studying alpine impacts that "where established trails exist and camping is restricted, fewer impacts are evident with current use levels because plants are protected elsewhere by adjacent steep and unstable terrain" and that damage more often occurred where snow or ice travel was not an option.

The results of one study aimed at finding out why visitors travel off- trail in the park found that a combination of four variables was primarily responsible in determining whether or not visitors exhibited behavior that affected park resources:

1) personal attitude about the effects of off- trail hiking;
2) where the visitor came from (out- of- state visitors violated less often);
3) the degree of human impact perceived in the meadow; and
4) exposure to written trailhead signs
5) and a later study (see below) showed the presence of a uniformed park employee to be more effective than any of the above).

A later series of studies in the subalpine meadows at Paradise (Johnson and Swearingen 1986, Swearingen and Johnson 1988, Johnson and Swearingen 1982) evaluated the effectiveness of signs and other strategies in decreasing minor rule violations, especially minimizing off trail use. These studies found that a trailside sign threatening a fine was about twice as effective as a humorous sign, a sign requesting meadow preservation and a symbolic sign. All of these were more effective than the then most common sign "No Hiking – Meadow Repairs." Even so, in the presence of the most effective sign, 1.8 percent of visitors continued to walk off trail. Finally, the study concluded that the presence of a uniformed park employee at or near the observation site eliminated off-trail hiking altogether (Johnson *et al*. 1994).

Another study (Johnson and Swearingen 1988) found that the frequency of non- compliance with minimum impact guidelines was greatest for groups over eight and lowest for single individuals. Few organized groups were part of the sample, so no conclusions about them could be drawn, however no difference in compliance and non- compliance was found on the basis of group makeup (individual family, friends, combination of both or organized). Approximately 40 percent of party size configurations from 1- 8 were non- compliant (went off- trail), whereas 67 percent of groups larger than 9 were non- compliant.

The same 1988 study cited above examined correlation regarding exposure to information, Minimum Impact Guidelines or NPS behavioral expectations via signs, media or interpretive talks and the resulting influence on compliant or non- compliant behavior. Although the correlation is weak, there was a significant difference in compliance based on exposure to some sources of information, including trailhead signs and frontcountry signs. Posters and naturalist talks appeared to have the least influence, although no evaluation of subject matter was identified.

Even on designated trails, visitors frequently step off to allow other parties to pass. As a result adjacent trailside vegetation often exhibits signs of impacts. A 1999 visitor survey (**Vande Kamp *et al*. 1999**) found that 21- 73 percent of visitors went off trail, depending on whether the visit was on a weekday or weekend and depending on the area visited. Comet Falls, Summerland, Mount Fremont and Glacier Basin visitors were sampled in the survey. More than half of visitors to Glacier Basin (63.6 percent) reported leaving the trail for more than a few feet. At Glacier Basin, 54.2 percent to 73.2 percent of visitors left the trail. Of the 73.2 percent of weekend visitors who left the trail, only 30 percent checked "went to the bathroom" as the reason. Exploring (41.8 percent) and visiting ponds or tarns (34.2 percent) were other popular reasons for leaving the trail. The range of reasons cited for off trail use in the 1999 study included: went to bathroom, view flowers/animals, explore, better view, snow, visit ponds/tarns, get away from people, be alone, don't know and other.

➢ WILDLIFE

Sixty species of mammals are known from Mount Rainier National Park. Another three occurred historically, but have not been documented recently. Small mammals include the deer mouse, dusky shrew, Townsend's chipmunk, Douglas squirrel, flying squirrel, hoary marmot, pika and snowshoe hare. Small and medium- sized carnivores include the long- tailed weasel, pine marten, and raccoon, striped and spotted skunks, river otter, bobcat, red fox and coyote. Large mammals include the black bear, black- tailed deer, elk, mountain goat and mountain lion. In addition, a number of bats occur in the park, including a nursing colony of the long- eared myotis and the state and federally sensitive Townsend's big- eared bat.

There are over 229 species of birds listed for the park, with approximately 80 of these known to nest in the park (see NPS 1995a: Checklist of the Birds of Mount Rainier National Park). Raptors include the northern goshawk, Cooper's hawk, red- tailed hawk, sharp- shinned hawk, peregrine falcon, merlin, bald eagle, golden eagle, northern saw whet owl, barred owl, great horned owl, western screech owl, etc. Other bird species include the gray jay, varied thrush, red- breasted sapsucker, common flicker, pileated woodpecker, Steller's jay, Oregon junco, hermit thrush, gray- crowned rosy finch, white- tailed ptarmigan, etc.

Approximately 21 species of reptiles and amphibians occur in the park. Some amphibians include the western redback salamander, Pacific giant salamander, northwestern and long- toed salamanders, tailed frog, Pacific chorus frog, red- legged frog, Cascades frog and western toad. Reptiles include the northwestern garter snake, western terrestrial garter snake, northern alligator lizard, rubber boa, and other species.

Eighteen native species of fish occur in the park, Including rainbow trout/steelhead, coho and chinook salmon, sculpin, bull trout and coastal cutthroat trout. In addition there are a number of introduced fish (including brook trout (*Salvelinus fontinalis*).

In addition, there are a wide variety of known and unknown invertebrates, including insects, spiders, worms, and freshwater mollusks.

Mount Rainier National Park is home to a wide variety of animal species. There are four distinct life zones in which animals occur, although some animals may inhabit several of the life zones depending on the time of year.

❖ Below 3,500 Feet

The lowest areas of the park (below 3,500 ft) are characterized by having mature forests of Douglas- fir, western red cedar, grand fir and western hemlock. This zone provides suitable habitat for the northern spotted owl (*Strix occidentalis caurina*), and marbled Murrelets (*Brachyramphus marmoratus*) (see specific information below under *Threatened and Endangered Species*). Other birds found in this life zone are barred owls (*Strix varia*), Cooper's hawk (*Accipiter cooperii*), varied thrush (*Ixoreus naevius*), brown creeper (*Certhia americana*), red-breasted sapsucker (*Sphyrapicus varius*), common flicker (*Colaptes auratus*), Steller's jay (*Cyanocitta stelleri*), red- breasted nuthatch (*Sitta canadensis*), Townsend's warbler (*Dendroica townsendi*), chestnut- backed chickadee (*Parus rufescens*), and winter wren (*Troglodytes troglodytes*). Many other birds occur in this zone which are seasonal visitors or year around residents.

The mammals found in this zone include Trowbridge shrew (*Sorex trowbridgii*), vagrant shrew (*Sorex vagrans*), dusky shrew (*Sorex obscurus*), the mountain beaver (*Aplodontia rufa*), Townsend chipmunk (*Eutamias townsendii*), Douglas squirrel (*Tamiasciurus douglasii*), flying squirrel (*Glaucomys sabrinus*), deer mouse (*Peromyscus maniculatus*), long- tailed meadow mouse (*Microtus longicaudus*), and Townsend vole (*Microtus townsendii*). The beaver (*Castor canadensis*) is found in low numbers along many of the streams and rivers in this zone. The raccoon (*Procyon lotor*), and spotted skunk (*Spilogale putorius*) are two carnivores which are only found in this zone. Other carnivores found in this zone include the pine marten (*Martes*

americana), bobcat (*Lynx rufus*), red fox (*Vulpes fulva*), black bear (*Ursus americanus*), coyote (*Canis latrans*), and mountain lion (*Felis concolor*). Black- tailed deer (*Odocoileus hemionus*) and elk (*Cervus canadensis*) can be found in this zone with the highest numbers found during the winter and early spring. Elk populations are the highest in the northeastern and southeastern area of the park. During the winter, mountain goats (*Oreamnos americanus*) can also be found in this zone. Native fish and amphibians are found in the lakes, ponds, streams and rivers in this zone. The fish found in the streams and lakes include rainbow trout (*Oncorhyncus mykiss*), cutthroat trout (*Oncorhyncus clarki*), brook trout (*Salvelinus fontinalis*), and bull trout (*Salvelinus confluentus*). Coho and steelhead occur in the Carbon and White Rivers, Chinook may also occur in the White River. Amphibians found in this zone include Cascades frog, tailed frog (*Ascaphus truei*), the rough- skinned newt (*Taricha granulosa*), Pacific giant salamander (*Dicamptodon tenebrosus*), larch mountain salamander and Van Dyke's salamander. The northern garter snake (*Thamnophis ordinoides*) and the common garter snake (*Thamnophis sirtalis*) are also found in this life zone. These amphibians and fish also occur in the higher elevation zones up to 6,500 feet.

❖ 3,500 to 5,000 Feet

The next zone of the park (3,500 to 5,000 feet) is characterized by its mixed forests of western white pine, western hemlock, and Pacific Silver fir. Blue grouse (*Dendragapus obscurus*) are found in this zone along with sharp- shinned hawk (*Accipiter striatus*), golden- crowned kinglet (*Regulus satrapa*), northern three- toed woodpecker (*Picoides tridactylus*), hermit thrush (*Catharus guttatus*), and yellow warbler (*Dendroica petechia*). Many bird species occur in this zone depending on weather, food sources, migration, and breeding season. Mammals in this zone include masked shrews (*Sorex cinereus*), Townsend chipmunk, yellow pine chipmunk (*Eutamias amoenus*), golden mantled ground squirrels (*Callospermophilus saturatus*), Douglas squirrels, flying squirrels, deer mice, and the jumping mouse (*Zapus trinotatus*). The large predators found in the lower zone are also found in this zone. The long- tailed weasel (*Mustela frenata*) and pine martin are very common in this zone. Mountain goats may be found in this area in the winter and spring. Deer and elk are common here, especially in the summer and fall. There are also Cascades and red- legged frogs, and larch mountain and Van Dyke's salamanders.

❖ 5,000 to 6,500 Feet

The elevational zone in the park which attracts numerous visitors in the summer is between 5,000 and 6,500 feet (where Paradise and Sunrise are located). This zone is characterized by mixed forest and subalpine meadows. The trees are primarily subalpine fir, mountain hemlock, Alaska yellow cedar, and whitebark pine and they tend to grow in clumps. The birds of this zone include the Clark's nutcracker (*Nucifraga columbiana*), common raven (*Corvus corax*), red- tailed hawk (*Buteo jamaicensis*), American kestrel (*Falco sparverius*), western flycatcher (*Empidonax difficilis*), rufous hummingbird (*Selasphorus rufus*), mountain bluebird (*Sialia currucoides*), and Lincoln's sparrow (*Melospiza lincolnii*). Many of these birds can be found in other zones depending on the season. This is the zone where elk congregate in the summer months, especially on the eastern half of the park. In this zone there are pika (*Ochotona princeps*), snowshoe hare (*Lepus americanus*), Hoary marmot (*Marmota caligata*), golden- mantled ground squirrel and yellow pine chipmunk. In the meadows are numerous pocket gophers (*Thomomys talpoides*). A common carnivore is the pine marten with black bear, coyote, red fox, and mountain lion visiting this zone in the summer and fall. There are some large herds of mountain goats in this zone. There are numerous ponds and lakes, some of which have been stocked with rainbow, cutthroat, and brook trout. Many of the ponds have populations of amphibians including northwestern salamander (*Ambystoma gracile*), long- toed salamander (*Ambystoma macrodactylum*), western toad and Cascades frog (*Rana cascadae*).

❖ Above 6,500 Feet

Over 80 square miles of Mount Rainier National Park is above 6500 feet. Snowfields, glaciers and bare rock outcrops, characterize this zone. There are many plant communities associated with these exposed areas. Insects and spiders are found at these elevations due to wind dispersal onto snowfields and glaciers. These organisms serve as food for numerous birds that visit the snowfields. The white- tailed ptarmigan (*Lagopus leucurus*) can be found in this zone along with

the Gray- crowned rosy finch (*Leucosticte arctoa*) and the water pipit (*Anthus spinoletta*). A variety of mammals more common in other zones may also visit this area.

➢ SPECIAL STATUS SPECIES

The following species are federal and/or state listed or proposed as threatened, endangered, sensitive or species of concern.

TABLE 3: SPECIAL STATUS WILDLIFE

FT = Federally Threatened
FE = Federally Endangered
FPROP = Federally Proposed
FSC = Federal Species of Concern
FC = Federal Candidate
ST = Washington State Threatened
SE = Washington State Endangered
SS = Washington State Sensitive
SC = Washington State Species of Concern
- - = No Status

WILDLIFE SPECIES	FEDERAL STATUS	STATE STATUS	HABITAT NEEDS OCCURRENCE
Northern Spotted Owl *Strix occidentalis caurina*	FT	SE	See detailed information below
Marbled Murrelet *Brachyramphus marmoratus marmoratus*	FT	ST	See detailed information below
Bald Eagle *Haliaeetus leucocephalus*	FSC	ST	Bald eagles migrate through the park and may occur in the vicinity from October 31 – March 31. Nesting occurs at nearby Alder Lake outside the west boundary.
Golden Eagle *Aquila chrysaetos*		SC	Golden eagles have been seen throughout the park in suitable habitat. They are believed to nest in the park. (NPS 1995a)
Merlin *Falco columbarius*		SC	Merlins are rare park visitors to subalpine areas in summer and occasionally are noted in fall. No known nesting occurs. (NPS 1995a)
Northern Goshawk *Accipter gentilis*	FSC	SC	Goshawks nest in trees in mature or old growth coniferous forests. Visitors and biologists regularly observe goshawks in the park.
Peregrine Falcon *Falco peregrinus*	FSC	SE	Peregrines nest primarily on cliffs along rivers or near lakes. In the spring and fall, migrants may pass through the park. Peregrines nest near the southwest corner of the park.
Ferruginous Hawk *Buteo regalis*	--	ST	Ferruginous hawks nest in cliffs or trees and frequent arid plains and open rangeland. Migrants may pass through the park.
Pileated Woodpecker *Dryocopus pileatus*		SC	Pileated woodpeckers are relatively common in low elevation forest.
Olive-sided Flycatcher *Contopus cooperi*	FSC	--	This flycatcher breeds in the park and prefers forest edges adjacent to open areas, such as burns, montane meadows, and subalpine areas.
Vaux's Swift *Chaetura vauxi*		SC	Vaux's swifts may be found in forested areas and are considered common in spring, summer and fall. They are believed to nest in the park. (NPS 1995a)
Gray Wolf *Canis lupus*	FE	SE	See detailed information below
Canada Lynx *Lynx canadensis*	FT	ST	See detailed information below
Grizzly Bear *Ursus arctos*	FT	SE	See detailed information below
California wolverine *Gulo gulo luteus*	FSC	SC	Wolverines inhabit high elevation coniferous forests and subalpine areas and have home ranges of up to 100 square miles. Wolverines were last documented in the park in 1933.
Pacific Fisher *Martes pennanti pacifica*	FSC	SE	See detailed information below

Long-eared Myotis *Myotis evotis*	FSC	--	Long- eared myotis' inhabit forests and chaparral. A nursing colony occurs near Longmire.
Long-legged Myotis *Myotis volans*	FSC	--	Long- legged myotis' forage over ponds, streams, open meadows and forest edges. Night roosts occur in caves or mines. This species occurs in the park.
Pacific Townsend's Big-Eared Bat *Plecotus townsendii townsendii*	FSC	SC	Big- eared bats hibernate in caves and use caves and abandoned buildings for breeding and roosting. Nursery colonies are extremely sensitive to human activity. Two hibernacula occur near Longmire.
Chinook Salmon *Oncohynchus tshawytscha* (Puget Sound ESU)	FT	SC	See detailed information below
Bull Trout *Salvelinus confluentus*	FT	SC	See detailed information below
Dolly Varden *Salvelinus malma*	FPROP	SC	Dolly Varden are proposed under the similarity of appearance provision of the Endangered Species Act. They occupy the same habitats and are nearly indistinguishable from bull trout.
Coho Salmon *Oncorhynchus kisuytch*	FPROP	--	Coho were historically found in the White, Carbon, Mowich and North and South Puyallup rivers. It is likely that they are present in small numbers in these rivers, however no surveys have confirmed this.
Coastal Cutthroat Trout *Oncorhynchus clarki clarki*	FPROP FT	--	The eastern Cascades portion of the coastal cutthroat is listed as threatened. Coastal cutthroats on the west were determined not warranted for listing. Although coastal cutthroat occur in the park, they are considered introduced.
Steelhead *Oncorhynchus mykiss*	FT	SC	An anadromous form of rainbow trout, steelhead may be present in the Carbon and White Rivers.
Cascades Frog *Rana cascadae*	FSC	--	Cascades frogs occur in mountainous areas, marshes and ponds. Distribution within the park is not well known. They have been documented throughout the park.
Western Toad *Bufo boreas*	FSC	SC	According to historic data, western toads were formerly more abundant in the park. They have recently been found in only a few montane lakes and wetlands.
Columbia Torrent Salamander *Rhyacotriton kezeri*	FSC	SC	This species occurs adjacent to the park and is expected to occur in the park.
Larch Mountain Salamander *Plethodon larselli*	FSC	SS	Larch mountain salamanders are found in forested and talus environments in cool, moist conditions under wood or rock. They have been found in several locations in the park.
Van Dyke's Salamander *Plethodon vandykei*	FSC	SC	This species is found in a variety of habitats, including streambanks, upland forests, talus areas and seeps at a range of elevations. They have been documented in several park areas.
California Floater Mussel *Anodonta californiensis*	--	SC	Freshwater mollusks inhabit permanent waters of all sizes. This one is expected to occur, but surveys have not confirmed it.
Fender's Soliperlan Stonefly *Soliperlan fenderi*	FSC	--	This species has been documented several times near the Westside Road and is expected to be present elsewhere in the park.

Northern Spotted Owl

The northern spotted owl is a medium sized nocturnal owl that preys primarily on small mammals. The owl is strongly associated with mature or old growth forests that are structurally complex – containing trees of several species, sizes, and ages, standing and down dead trees, with multistoried canopies. Moreover, the birds require large amounts of such habitat. Median home range sizes are typically on the order of 3,000 to 5,000 acres per pair. Spotted owls nest in cavities

or platforms in trees, and in good habitat, pairs are typically spaced about 1–2 miles apart. Spotted owls are long- lived, territorial birds, often spending their entire adult life in the same territory. Spotted owl pairs begin to roost in February or March. In late March or early April, the female will lay 1 to 3 eggs. Young are fed by both parents until August or September, although fledging may occur in May or June and by October the young disperse from the nest site. Northern spotted owls' nesting and fledging season extends from March 1 through September 30 and in western Washington a late nesting season has been characterized, beginning on July 15. Nest trees may include Douglas- fir, grand fir, Pacific silver fir and other species and are usually found in forests up to 4,800 feet in elevation.

Habitat degradation and loss threaten this species with extinction. Much of the remaining habitat is highly fragmented. In addition, barred owls *(Strix varia)* have invaded much of the range of the northern spotted owl during the last 30 years and have displaced and hybridized with spotted owls (Dunbar *et al.* 1991; Thomas et al. 1993; Hamer *et al.* 1994). Since listing, Anderson and Burnham (1992) indicate northern spotted owl populations are continuing to decline throughout their range and this decline may be accelerating. Large scale analysis of the northern spotted owl over 23% of its range, including Mount Rainier National Park, indicated that populations were either relatively stable or were experiencing a decline (3.9% annually for female owls) (Franklin et al. 1999). Critical habitat for the species has been designated within Lewis and Pierce Counties, but the designation does not include lands within Mount Rainier National Park, which are presumed to be protected. The northern spotted owl is an uncommon year- round resident of the park (breeding between March and September). The park contains approximately 68,000 acres of suitable habitat. Approximately 85% of that suitable habitat was surveyed between 1997 and 1998. A total of 13 pairs of adult owls, 10 single owls, and nine activity sites, seven of which are known to be successful were found. In six of these the nest trees were also found. The owls from the successful nests produced 12 juveniles, of which 8 were banded. (One juvenile was killed by a car.) Many known locations for spotted owls are within 1 to 2 miles of the park boundary. They have been reported in forests along Westside Road, near the Longmire complex, at Ohanapecosh, near the Sunrise complex, along the State Route 410 corridor, and along Carbon River Road. Numerous nest activity sites have been located in the park.

Marbled Murrelet

The marbled murrelet is a small seabird that feeds on fish in ocean waters within 1 mile of the shore. Due to their secretive nature and cryptic coloration, information on the distribution and abundance of marbled murrelets in Washington has been difficult to gather (NPS 1996a). Marbled murrelets nest in forested areas up to more than 55 miles from their saltwater foraging areas. Nest trees need to be in a stand that is open enough for them to fly through, yet the canopy must have enough cover to hide the nests from predators. Typically such conditions have only been found in old growth or later seral stands, however some younger stands with a high degree of structural diversity and limb- malforming infestations (i.e., mistletoe) may also be suitable. The marbled murrelets' threatened status is thought to be principally due to a loss of nesting habitat due to commercial timber harvesting. Forest fragmentation also may be making nests near forest edges vulnerable to predation by other birds, such as jays, crows, ravens, and great horned owls. In addition, increased human activities in forests, such as picnic grounds, can attract corvids and thus increase the chances of predation (USFWS 1991, 1992). Critical habitat for the species has been designated within Lewis and Pierce Counties, but the designation does not include lands in Mount Rainier National Park for the same reasons as noted above for northern spotted owl habitat designation. Potential marbled murrelet habitat is distributed throughout the park, especially along major river corridors below 3,500 feet. Confirmed nesting behavior is documented in the northwest corner of the park in the Carbon River and Mowich River drainages, and murrelets have been detected via RADAR along the Nisqually River within the park. Approximately 22,000 acres of the park are considered suitable nesting habitat. The old growth forests in the park's western river valleys may be some of the best remaining nesting habitat in the southern Puget Sound area because they support large, intact stands of old- growth forest within 55 miles of the birds' marine foraging area. Limited non- systematic inventories for murrelets were conducted from 1995- 1997, primarily in the northwestern portion of the park. A total of 891 murrelet detections were made in 1995, 92 in 1996 and 220 in 1997. These detections represent an

unknown number of murrelets because an individual bird may be detected numerous times over the course of the monitoring season. Some of these detections, however, were identified as an indication of nesting occupancy based on observations of bird behavior on 42 occasions in 1995, 3 in 1996 and 69 in 1997. In addition, four other suspected nesting areas, based on repeated observations of murrelets exhibiting nesting behavior, were identified in 1997. Recent monitoring documents continued nesting in both the Carbon and Mowich River areas.

Gray Wolf

Gray wolves are wide ranging carnivores that inhabit forests and tundra. They were eliminated from Washington by the early 20th century, but now appear to be naturally recolonizing some areas from Canada. Gray wolves were historically found in the park. Numerous observations were recorded from the late 1800s – 1920s (Taylor and Shaw 1927). Although numerous observations have occurred in the last 20 years, none has been confirmed by biologists. The Washington Department of Fish and Wildlife (WDFW), however, maintains a database of a small number of these considered to be reliable observations. Semi- domesticated hybrid wolf- dogs were documented in the eastern portions of the park during the 1990s. These animals were apparently removed (on adjacent lands) by WDFW. Several have come from near or within the eastern part of the park. No systematic studies, however, have been conducted.

Grizzly Bear

Grizzly bears are omnivores that inhabit semi- open country, usually in mountain areas. They require large home ranges from 30 to 100 square miles in size (Van Gelder 1982). The park contains suitable grizzly bear habitat, but there have never been confirmed sightings of grizzlies in the park. In 1993, grizzly bear tracks were identified near the west boundary of the park.

Canada Lynx

In the Cascade Mountains, lynx live in the spruce- fir forests of the high mountains. Older, mature forests with downed trees and windfalls provide cover for denning sites, escape, and protection from severe weather. The distribution and abundance of lynx tend to be tied to that of its primary prey, the snowshoe hare. Canada lynx probably never have been abundant in most of the lower 48 states because of a lack of lynx and snowshoe hare habitat. Their numbers declined due to over-trapping in the 1980s and from a loss of forest habitat caused by development and urbanization, forest fire suppression, and unsuitable types of forest management. Bobcats and coyotes also have spread into lynx habitat. Biologists suspect that packed snow trails created by recreational activities could allow bobcats and coyotes to compete with lynx for food and space.

Pacific Fisher

Pacific fishers inhabit dense forests, with extensive continuous canopies and complex forest floor structures and are often associated with wetland or riparian areas. Fishers have declined throughout their range and may be on the verge of extinction in Washington State. Fishers were last documented in the park in 1947, with more recent unconfirmed observations in the 1990s. A state reintroduction program is in planning development but immediate release sites are not likely to include the park. A 1991 study in the southeastern park did not detect them (Jones and Raphael 1992), nor did recent hair snare and remote camera bait station surveys(1999- 2001).

Chinook Salmon

Chinook are easily the largest of any salmon, with adults often exceeding 40 pounds. Chinook use a variety of freshwater habitats, but it is more common to see them spawn in larger main stem rivers or tributaries. In Mount Rainier, habitat for Chinook salmon includes the Carbon, White, Mowich, and Puyallup Rivers, the West Fork of the White River, and Huckleberry Creek. Chinook have been documented in the park.

Bull Trout

Bull trout habitat is characterized by clear cold water, silt- free rocky substrate in riffle run areas, well- vegetated streambanks, abundant in stream cover, deep pools, relatively stable flow regime and streambanks, and productive fish and aquatic insect populations. Historically, they were found in most major river systems in the Pacific Northwest. In Mount Rainier, bull trout are present in the White, West Fork, Carbon, Mowich and Puyallup Rivers and their tributaries.

PLANTS

The following plants are all considered state sensitive and do not have federal status.

TABLE 4: SPECIAL STATUS PLANTS

PLANT SPECIES	HABITAT NEEDS OCCURRENCE
Obscure Indian Paintbrush *Castilleja cryptantha*	Park and area endemic. Found in 25 sites in park and 2 sites adjacent to park. Populations are located in moist, well-drained meadows in northern part of park. Surveys have shown that although numerous individuals were present, no seedlings have germinated. Based on surveys, there apparently is great variability in population trends among locations and between years.
Mount Rainier Lousewort *Pedicularis rainierensis*	Observed in 34 subalpine meadow locations.
Lance-leaved Grapefern *Botrychium lanceolatum*	Observed in 3 locations.
Common Moonwort *Botrychium lunaria*	One voucher specimen is located in park herbarium.
Northern Moonwort *Botrychium pinnatum*	Two voucher specimens (1888, c. 1960) in park herbarium.
Little Grapefern *Botrychium simplex*	Observed in 2 locations in 2001.
Northern Microseris *Microseris borealis*	Observed in 4 locations.
Wheeler's Bluegrass *Poa nervosa*	Based on habitat, this species is expected to occur, but surveys have not confirmed it.
Crested Wood-fern *Dryopteris cristata*	Same as above.
Curved woodrush *Luzula arcuata*	Observed in 1 location.
Northern wild licorice *Galium kamtschaticum*	Observed in 1 location.
Skunky Jacob's-ladder *Polemonium viscosum*	One voucher specimen (1896) in park herbarium.
Pygmy Saxifrage *Saxifraga rivularis*	One voucher specimen (1895) in park herbarium.
Blackened sedge *Carex atrosquama*	One voucher specimen (1895) in park herbarium.
Tall agoseris *Agoseris elata*	Based on habitat, this species is expected to occur, but surveys have not confirmed it.

➢ PREHISTORIC AND HISTORICAL ARCHEOLOGY

Only a small percentage of the park has been surveyed for archeological resources. As of the 2002 field season, the park had documented 40 prehistoric and multi- component (prehistoric and historic) sites, 29 prehistoric isolated finds, and 31 historic sites and isolated finds. Most documented archeological sites (74 percent) are found within subalpine communities, with approximately 16 percent in alpine habitats. The rest (10 percent) have been found in forested habitats, where more continuous vegetative cover and deposition, makes it difficult to detect archeological remains. Of these, 75 percent of sites are found on slopes of 5 degrees or less and 75 percent are within 300 feet of water. Archeological modeling predicts the greatest intensity of prehistoric use in subalpine communities and in the upper forest margins that would have supported similar communities as recently as the last "Little Ice Age" approximately 500- 150 years ago.

The oldest confirmed dated deposits come from an estimated 3,500 years before the present. Other preserved stratigraphically dated profiles, indicate buried soil to 8,500 years ago. It is likely that the archeological record in the park will be extended to that period. Very early sites are difficult to locate, owing to burial 3- 5 feet below the surface.

The most intensive survey efforts have been associated with rehabilitation and construction related projects in the developed areas of the park (including trails and backcountry camps) during the last ten years. Less intensive reconnaissance efforts have focused on subalpine and alpine landscapes, and several forest settings. Other survey efforts have concentrated in areas where known archeological resources have been reported. Understanding of the park's prehistoric use patterns is based on the results of these surveys, on the archeological record in the vicinity of the park, and on environmentally- based models of human subsistence and settlement patterns in mountainous environments (Burtchard 1998). Knowledge of the historical archeological record also relies on these sources, plus written records, informant accounts and historic documents.

Prehistoric archeological evidence is dominated by low to moderate- density lithic scatters, most of which are exposed on the soil surface. Dominant materials are cryptocrystalline silicate rock, most of which originated outside the park. Because of the volcano's depositional history, a relatively small fraction of the total remainder of artifacts anticipated is found on the surface. As a result, most of the material is found under the surface, providing some protection from direct fire effects, but not from firefighting effects. Historic artifacts are more likely to contain wood components and would be the most vulnerable to fire.

➢ ETHNOGRAPHY

Ethnographic resources are defined as landscapes, sites, structures, objects or natural resource features that have significance based on importance attached to them by members of socio-cultural groups. At Mount Rainier, these resources are most closely associated with at least six contemporary Native American tribes – Nisqually Indian Tribe, Muckleshoot Indian Tribe, Puyallup Tribe of Indians, Confederated Tribes and Bands of the Yakama Nation, Cowlitz Indian Tribe, and Squaxin Island Tribe.

Mount Rainier has long been an important place and a symbolic landmark for Native Americans. In addition to hunting, archeological evidence suggests that prehistoric people used high elevation and forested landscapes on Mount Rainier to gather a variety of economic, medicinal and ceremonially important resources for thousands of years (Burtchard 1998). Investigations into the archeology, history and ethnography of Mount Rainier National Park (Smith 1964, Thompson 1981, Catton 1996, Carr 1997, Boxberger 1998, Burtchard 1998, and Onat 1999) indicate that these practices continue into the twentieth century as well. Among other products, gathering beargrass and cedar splits for basketry and collecting plants for medicinal, ceremonial and religious uses has been documented through 1950 (Boxberger 1998). Similar uses continue to the present. While few specific ethnographic resources, other than archeological sites, have been documented to date, it is important to recognize that Mount Rainier remains important as a place for spiritual and traditional use to Indian people today.

Native American use of the park continues to this day, with some tribes possessing or negotiating agreements for the collection of specified quantities of native plants to continue cultural traditions. It is possible, perhaps probable, that significant but undocumented archeological and ethnographic resources, (including ceremonial locations) exist throughout the park in areas used by the current Native American Tribes and prehistoric use by ancestors of these peoples. Other, less known use for ceremonial or spiritual purposes also occurs but has not been well-documented.

➢ HISTORIC STRUCTURES

There are approximately 158 historic resources in the park individually and collectively listed on the National Register of Historic Places. Many more sites, structures and objects are potentially eligible for the National Register. Prior to designation of the Mount Rainier National Historic

Landmark District, six historic districts were designated in the park for their rustic architectural significance. These include:

- Nisqually Entrance Historic District
- Longmire Historic District
- Paradise Historic District
- Camp Muir Historic District
- White River Entrance Historic District
- Sunrise Developed Area Historic District

Each of these historic districts exhibits significant examples of NPS rustic architecture in the style of the period of its development. In addition, there are 5 National Historic Landmark buildings or building complexes that have been designated in the park. These represent the some of the best designs of the period and, in many cases, were used as models in other National Parks for similar structures. They include:

- Longmire Community Building,
- Longmire Administration Building,
- Longmire Service Station,
- Paradise Inn, and the
- Sunrise Blockhouses/Stockade Complex.

Of the historic districts listed above, only Camp Muir would be affected by the proposals in the Commercial Services Plan. The current climbing concessioner is assigned the use of the Camp Muir Cookhouse, the Bunkhouse (Gombu/Client Shelter), and several toilets, including a concessioner- only pit toilet (from which solid waste is removed). Recent revisions to the contract removed the use of the Paradise Guide House, which was no longer needed for equipment rental and office space. GSI would continue to use the facilities identified in their contract (Paradise Inn, Paradise Guide House, portions of the Jackson Visitor Center, Sunrise Lodge, National Park Inn, Longmire General Store, and other housing facilities until 2012.

➢ CULTURAL LANDSCAPES

The Mount Rainier National Historic Landmark District was designated in 1997. This large and exceptional District, now on the National Register of Historic Places (under landscape architecture), contains 97 historic buildings and 60 historic structures (including most of the park's road system and the Wonderland and Northern Loop trails) as well as 31 other listed features. Together, these resources are considered to be the best example of park master planning in the National Park System. Collectively, they represent an important stage in National Park development history. At Mount Rainier in the 1920s and 1930s, the NPS Landscape Planning Division invented and defined modern National Park planning. Consequently, the Master Plan for Mount Rainier, completed in 1929, was the first National Park master plan developed by the NPS and it was and is considered a model of NPS planning. The degree of conformance to the plan still present in the park is outstanding. As a whole, no other collection of park roads, bridges, developed areas and trails is more completely preserved as an intact example of National Park planning and design of the period 1904- 1957. The goal, then as now, was to integrate all park systems and facilities in a unified plan that would ensure the best possible visitor experience while severely limiting how much development would be permitted in the park (Carr 1998). The master plan was executed in the rustic style of architecture and the naturalistic style of architecture, using native materials and natural forms to blend constructed works with their environment.

The designation of a NHLD recognizes that the park does not simply contain individual historic resources, but is itself an historical park. The historic roads, trails, buildings and designed landscapes of the park together comprise a cultural landscape of national significance in American history. Twenty- nine Cultural Landscapes have been identified that occur in a variety of vegetation types on the north, south, east and west flanks of Mount Rainier. The significance of the NHLD is divided into the following size categories, which recognize contributing resources:

- Spatial organization – the composition and sequence of outdoor spaces within the district;
- Circulation – the means and patterns of movement through the district;
- Topography – the ways in which the landscape planning responds to the topographic features of the site and the modifications of that topography;
- Vegetation – the response of existing vegetation as well as the management of vegetation through pruning, removal or addition of trees and shrubs;
- Structures – all contributing structures, including roads, trails and other small scale features such as rock walls and culverts; and
- Buildings – structures intended to shelter a human activity.

Approximately one- third of the park's cultural landscapes have had Level I or Level II Cultural Landscape Inventories completed (i.e. 10 of 29). Another approximately 20 Cultural Landscape Inventories and 25 Cultural Landscape Reports are needed to document known cultural landscapes. Even so, there is a great deal of known information that has not yet been documented through these formal inventory processes. Three Cultural Landscape Reports and three Development Concept Plans also document rehabilitation treatment for 6 cultural landscapes.

➢ VISITOR EXPERIENCE

❖ Visitor Use Opportunities

Park visitors participate in a wide array of recreational activities, including camping, hiking, scenic driving, mountain climbing, skiing, snowshoeing, and walks to nearby viewpoints. The following summary identifies the primary visitor use activities commercial visitors engage in. See the description of Alternative 1 (No Action) for a better understanding of the current range of visitor activities offered by park commercial businesses.

Climbing: Mount Rainier, the tallest and largest glaciated peak in the contiguous 48 states, is considered to be one of the best climbing opportunities in the United States. Looming like "an arctic island in a temperate sea" it beckons climbers from the Seattle area and beyond. Every year, thousands of climbers attempt its 14,410- foot summit. Twenty- six major glaciers, over 35 recognized climbing routes and severe weather combine to create the climbing challenge that is Mount Rainier. Because of its glaciers, crevasses and snow bridges and often unpredictable weather, Mount Rainier is considered a training ground for tougher endurance climbs like Mount McKinley and Mount Everest. In 2001, of the park total estimated annual visitation (1,940,104), 11,688 people or one percent participated in climbing and of those, 4,165 or 36 percent participated in commercially guided climbing. Similarly, of the respondents to the 2000 visitor use survey (Simmons et al. 2001) asked what activities they participated in, just three percent identified climbing to the summit of Mount Rainier.

Wilderness Use: With 97 percent of its 235,625 acres designated as wilderness and the 93 mile long circumnavigation Wonderland Trail, Mount Rainier is an attractive place to enjoy forested, subalpine and alpine hiking environments. Although the greatest majority of park wilderness users come just for the day (69 percent), about 73 percent engage in wilderness day hiking. Of these, approximately six to eight percent indulge in an overnight backpacking trip (Simmons *et al.* 2001). In 2001, an estimated 132 people participated in a commercially guided day or overnight wilderness experience and 180 people participated in an overnight guided alpine wilderness experience (not including commercial mountaineering).

Skills Instruction: With its easily accessible glaciers, incredible winter snow pack and extensive forests and subalpine environments, Mount Rainier is also an ideal place to introduce novice hikers and climbers to outdoor recreation opportunities. Mount Rainier has the distinction of having both, the lowest elevation glacier (Carbon), the largest glacier (Emmons) in the continental U.S, and the glacier with the longest record of measurement (Nisqually). All are easily accessible. The concession guide service has run a mountaineering day school skills course in the Paradise area since the 1970s teaching ice axe arrest and roped travel both for potential summit climbers

and other interested visitors. In 2001, approximately 2,500 people participated in this training, which may be taken independent of participation in guided climbs to Camp Muir. Recently this concessioner has also begun offering glacier day hikes (advertised for any one of the 26 named glaciers).

Bus and Van Road Tours: Based on initial analysis, an estimated 200 companies, serving an unknown number of park visitors, conduct road- based commercial tours in the park, coming at varying intervals, including daily, weekly and less frequently. These tours conform to policy and regulations set nationally. There is another much smaller subset of road- based tour companies that hold Incidental Business Permits for conducting specific activities (often including camping or hiking) in the park.

Shuttles: (See also *Summary of Day Use* below.) Shuttle transportation is very limited to and within the park. One park permit holder offers transportation from Ashford to Longmire and Paradise and also has sought business outside the park from the SeaTac airport to Ashford. Approximately 259 people were served in 2001. Another park permit holder offers an on- call, reservations shuttle service anywhere in the park, as well as outside the park to SeaTac airport. Approximately 323 people were served in 2001. Both occur year- round, though more frequently in the summer. Parkwide shuttles are called for in the park GMP (NPS 2001). In the 2000 Visitor Use Survey (Simmons *et al.* 2001), when asked about their willingness to ride a free "transport bus," 70 percent of respondents said "yes", while 20 percent said "no" and 9 percent were "undecided." When a projected per person cost of up to $10.00 was used for the same question, the number of "yes" responses dropped significantly to 29 percent and the number of "no" responses rose to 53 percent and the number of "undecided" responses rose to 18 percent (Simmons *et al.* 2001).

Winter Recreation: With an annual snowfall total often exceeding 600 inches a year (and over 1,100 inches in the record year) portions of the park offer winter enthusiasts ample opportunities to ski, snowshoe and snow- camp. Approximately 89 people participated in guided winter recreational activities led by GSI in 2001.

❖ Visitor Use Access Trends

Origin: Visitors come to Mount Rainier National Park from all over the United States and from other countries. According to a 1990 survey (Johnson *et al.* 1991), the majority of park visitors were from Washington State (59 percent). Others were from California (5 percent), Oregon (3 percent), and other states (30 percent), with about 3 percent from foreign countries. The 2000 Visitor Use Survey (Simmons *et al.* 2001) similarly found that 60 percent were from Washington State, 5 percent from California, 3 percent from Oregon, but about 6 percent were from foreign countries.

Access/Facilities: There are five primary entrances to the park, including the Nisqually (southwest) – where approximately 54 percent of park visitors enter, Carbon River (13 percent of visitors)/Mowich Lake (13 percent of visitors) (northwest), Highway 410 (northeast)/Highway 410 (east) (26 percent of visitors) and Stevens Canyon (Highway 123/southeast) (16 percent of visitors) (Simmons *et al.* 2001). Developed areas are located throughout the park at Nisqually Entrance, Longmire, Paradise, Carbon River, Mowich Lake, Ohanapecosh, Sunrise and White River. Minor developed areas are located at Reflection Lakes, Box Canyon, Tipsoo Lake, and Grove of the Patriarchs, among others.

Most visitors travel by car, however a fair number come through on guided bus or van tours and a very small number use area shuttles for access to and within the park. There no public bus transportation to the park and little currently within the park (see Shuttles above).

Visitation: Located an hour and a half from metropolitan Puget Sound, Mount Rainier is not only within easy access of over 2 million people, it is also one of the most popular visitor attractions in the Pacific Northwest. About 80 percent of visitor use occurs between May and October

(Johnson *et al.* 1990). In 2000, there were 1,970,406 visits. The number of visitors to the park has varied little over the last 11 years. The highest visitation in the past decade was 1992, with 2,358,296 visitors.

Table 6: Mount Rainier National Park Visitation 1989-2002

Year	Total Visits	Year	Total Visits
1989	2,012,900	1996	1,868,525
1990	1,936,215	1997	1,820,481
1991	2,235,591	1998	1,901,301
1992	2,358,296	1999	1,764,091
1993	2,192,062	2000	1,970,406
1994	2,206,083	2001	1,940,104
1995	2,181,396	2002	1,899,512

From Mount Rainier National Park General Management Plan 2001.

Visitation is highly dependent on regional weather conditions. Visitors are drawn to the park from the surrounding region when the weather is clear and the mountain is visible, particularly on weekends. Visitation figures may also be affected by other external factors, such as road construction or flood damage on major access routes, or may vary due to changes in methods of counting visitors.

Peak Season: Park visitation begins to increase in spring, peaks in July and August and decreases substantially beginning in October. During the peak season, park visitors regularly represent at least 40 percent and sometimes exceed half of all annual visitors (with over 1 million visitors counted in these two months alone).

Group Size: According to a 1999 summer day use visitor survey, most independent wilderness visitors travel in groups of two (50 percent), three (16 percent), or four (14 percent). Nine percent traveled in groups of 5- 9 and only one percent traveled in groups of 10 or more (Vande Kamp *et al.* 1999). Similarly in the 2000 Visitor Use Survey, most park visitors traveled in groups of one (8 percent), two (42 percent), three (18 percent), four (14 percent), five (8 percent), and 5- 10 (8 percent). Only two percent of groups contained 11 or more people (Simmons *et al.* 2001).

Guided vs. Non-guided Groups: Notably, many overnight guided groups in the park now have a maximum party size of 12. The current climbing concessioner, however, conducts the greatest number of overnight activities and has an average party size of about 15 (with 3 guides and 12 clients), although beginning in 2003, the maximum concessioner group size will be 12 in wilderness and 15 in the frontcountry. During the Vande Kamp survey (above), however, no guided groups were revealed by responses.

Commercial vs. Independent Visitors: As noted above, a very small percentage of park visitors currently participate in guided activities, from just over a hundred each for guided wilderness and guided alpine wilderness, to several hundred for shuttles, and several thousand for guided climbing. The majority of park visitors using commercial services in the park are taking advantage of front- country services, such as dining, snack bars and lodging (as shown below, for instance, 21- 30 percent of overnight visitors stay at an Inn).

TABLE 7: PERCENT OF TOTAL OVERNIGHT VISITOR USE 1985, 1990, 1993 and 2000

Overnight Location	1985	1990	1993	2000
Alpine camp or zone	5	11	29	20
Wilderness camp	7	15		
Cross-country area	2	3		
% Total Wilderness Use	14	29	29	20
Developed Campground	52	55	38	52
Inn	21	29	30	33
Other				7

(Numbers shown represent percentages of total overnight visitors. The totals for a particular year may be higher than 100 since visitors may stay in more than one overnight location per visit. Data compiled from Salvi and Johnson 1985, Johnson et al. 1990 and Vande Kamp, Swanson and Johnson 1999 and Simmons et al. 2001.)

Availability of and Trends in Visitor Use

Park visitor use can be divided into non- wilderness or "frontcountry" and wilderness use. This use can also be classified into day or overnight use.

Type of Use: Between 66 and 86 percent of all park visitors come just for the day (Salvi and Johnson 1985, Johnson *et al.* 1990, Simmons *et al.* 2001).

The 1985 visitor use survey (Salvi and Johnson 1985) found that just 23 percent of visitors surveyed over 12 weeks stayed in the park. The 1990 visitor use survey (Johnson *et al.* 1990) found that even fewer visitors (14 percent) stayed in the park. More recent surveys (Simmons *et al.*) showed that f those who did stay overnight 18 percent did not stay in the park. The table above shows the distribution of where overnight visitors stayed. Wilderness use varied from 13 to 29 percent, while non- wilderness use varied from 38 to 55 percent and inn use varied from 21 to 30 percent.

In 1985, most visitors who reported using developed campgrounds stayed two or more nights (2.5 average), while those who reported staying in wilderness were there one or more nights (1.3 - 1.4) (Salvi and Johnson 1985). In 1990, the average visitor to a developed campground stayed more than two nights (2.5), while the average visitor to a wilderness camp stayed two nights (1.4 – 2.5) (Johnson *et al.* 1990). In 1993, average overnight stays were 2.1 nights at wilderness campsites, 2.5 nights at drive- in campgrounds, and 1.6 nights at an inn or lodge (NPS 2001). In 2000, inside the park, 31 percent of visitors stayed one night, 26 percent two nights, 13 percent three nights, 4 percent 4 nights, two percent 5 nights and 6 percent more than 5 nights (Simmons *et al.* 2001).

Between 1989 and 2001, use of park wilderness rose 69 percent. Over the same period, there was a 55 percent increase (from 7,535 to 11,688) in the number of overnight climbers.

TABLE 8: TOTAL OVERNIGHT CLIMBING VISITOR USE BY ROUTE (1989-2001)

YEAR	MUIR	EMMONS	KAUTZ	OTHER	SUBTOTAL Independent Use	SUBTOTAL Concession & IBP	TOTAL Independent, Concession & IBP Use
1989	3,117	1,304	488	466	5,375	2,159	7,534
1990	3,217	1,334	380	509	5,440	2,629	8,069
1991	3,296	1,678	516	559	6,049	2,203	8,252
1992	3,596	1,700	354	425	6,075	3,177	9,252
1993	*	1,694	*	*	*	3,004	*
1994	4,030	2,120	400	695	7,245	2,815	10,060
1995	4,011	1,914	557	685	7,167	3,262	10,429
1996	3,656	1,945	179	661	6,441	2,899	9,340
1997	4,812	1,506	158	665	7,141	3,184	10,325
1998	4,339	2,259	666	593	7,857	3,778	11,635
1999	4,010	1,987	446	514	6,957	3,801`	10,758
2000	#	#	#	#	8,594	4,378	12,972
2001	4,621	1,907	474	521	7,523	4,436	11,959

Table 8: Continued: Percent Independent vs. Concession Use 1989-2001

YEAR	% total independent use	% total concession use
1989	71	29
1990	67	33
1991	73	27
1992	66	34
1993	*	*
1994	72	28
1995	69	31
1996	69	31
1997	69	31
1998	67	33
1999	65	35
2000	66	34
2001	62	37

Summary of Day Use

Although understanding of park overnight use is moderately well- developed as a result of overnight use limits established by the Wilderness Management Plan and because of overnight developed campground space limitations, what percentage of time day use visitors spend in different activities. From various visitor use surveys, however, the following activities often rank high: day hiking (73 percent), viewing wildflowers (63 percent), driving to view scenery (63 percent), photography (56 percent) going to visitor centers (53 percent), etc. Other activities include: viewing wildlife, visiting lodges or inns, picnicking, camping, attending ranger programs, wilderness camping, climbing, fishing, bicycling and other (Simmons et al. 2001).

Because there are currently no limits on day use and because permits are not required for day use visitors, few tracking systems or monitoring methods have been established. One study for the GMP, however attempted "Describing and Estimating the System of Visitor Distribution in Mount Rainier National Park" (Vande Kamp *et al.* 1997). This study identified the following highlights:

- demand for parking exceeds parking lot design capacity on peak days (sunny summer days)
- visitation is influenced very heavily by weather conditions (28 percent less on poor weather weekend days and 43 percent less on poor weather weekdays)
- visitation peaks in mid- to late- afternoon

As a result, implementing a visitor transportation system it concluded would likely be difficult to design. "Systems that have the capacity to transport all visitors on good days will have surplus capacity on poor weather days, and given the fickle nature of weather in the Puget Sound region, prediction of demand (and planned deployment of transportation equipment and staff) will be extremely difficult on anything but a very short- term basis" (Vande Kamp *et al.* 1997)

Summary of Frontcountry Developed Campground Visitor Use

Based on the range of overnight use (developed by Johnson *et al.* 1990 and Salvi and Johnson 1985), between 14 and 23 percent of visitors stay in the park overnight. Analysis of individual sites in developed campgrounds shows the following capacities in summer if every site were filled every night with the half the maximum number of people and group sites contained 25 people:

TABLE 9: SUMMER CAMPGROUND OVERNIGHT POTENTIAL

Cougar Rock 110 nights 185 sites	122,100	**Sunshine Point** 140 nights 18 sites	15,120
Ipsut Creek 140 nights 30 sites	25,200	**White River** 97 nights 118 sites	68,676
Ohanapecosh 110 nights 202 sites	133,320	**Group Sites** Cougar Rock = 5 Ohanapecosh = 1 Ipsut Creek = 2	 13,750 2,750 7,000

Based on 2001 visitation figures (1,940,104) this would mean that between 271,614 and 446,224 people stayed in the park and that of these, approximately 50 percent stayed in developed campgrounds.

This comparison demonstrates that although approximately 50 percent of all park overnight visitors stay in developed campgrounds, that more capacity remains (particularly during weekdays). Against this background, the current rate of commercial camping visitor use comprises only a small fraction of total use and is currently regulated to two sites on weekends at Cougar Rock Campground. In 2001, an estimated 291 commercial visitors used park campgrounds (although the actual number may be higher due to inadequate documentation methods).

Summary of Overnight Climbing Visitor Use

In 1985 two percent of visitors' surveyed reported day hiking to Camp Muir and two percent reported technical climbing (Salvi and Johnson 1985). Less than one percent reported engaging in guided technical mountain climbing, and one percent reported engaging in self- led technical climbing, while four percent reported engaging in non- technical mountain climbing (Johnson *et al*. 1990). In 1999, just two percent of wilderness visitors surveyed reported using equipment to mountain climb (Vande Kamp *et al*. 1999). Today, the more than 11,000 climbers comprise a very small number of park visitors – approximately one- half of one percent of the park's annual visitation (Climbing Cost Recovery Report 2002).

Looking at Table 8 above, beginning when climbing statistics began to be recorded, climbing use of Mount Rainier has soared from 238 climbers in 1950 to 11,678 climbers in 2001 – a 49- fold increase. Climbing in 2000 reached an all time high of 13,114 people. With a few notable exceptions climbing has increased every year. The period 1991- 2001 showed an average increase of 2.73 percent per year (Pricewaterhouse Coopers 2002). The Muir Route is the most popular, followed by the Emmons and Kautz routes and others. In 2001, use of the Muir Route was 8,766 (total), 4,145 (concession), use of the Emmons Route 1,907 (total), 192 (IBP), and use of the Kautz Route 474 (total), 41 (concession). The Fuhrer's Finger and Liberty Ridge routes followed with 118 and 115 people attempting to summit. As shown below, based on National Park Service climbing permit data, actual use of the Muir Route has increased by approximately 48 percent over the last 12 years. Use on the Emmons Route has increased similarly with 46 percent, and use of the Kautz Route, has fluctuated, although comparison of the 1989 and 2001 data shows a slight (3 percent) decrease and use on Other Routes is up approximately 12 percent. Overall, there has been a 92 percent rise in concession use and a 40 percent rise in independent use over the past 12 years.

By contrast, the following table shows the maximum number of user nights that could occur if available space (denoted in the Wilderness Management Plan overnight use limits) in each major climbing route camp was filled every night in summer.

TABLE 10: SUMMER MAXIMUM POTENTIAL USER NIGHTS BY PRIMARY ROUTE

(based on Wilderness overnight use limits)

Route	Muir	Emmons	Kautz
Available overnight space	15,400 Camp Muir	4,800 Camp Schurman	5,040 Alpine Kautz
Available overnight space	5,040 Muir Snowfield	2,400 Emmons Flats	5,040 Camp Hazard
	5,040 Ingraham Flats	2,400 Inter Glacier	- - -
	- - -	3,600 Glacier Basin	- - -
Total	20,440	10,080	10,080

Summary of Wilderness Visitor Use

According to visitor use studies, most wilderness visitors take walks or hikes (98.9 percent), but of these only eight percent camped or backpacked overnight in wilderness(Vande Kamp *et al*. 1999). The other 92 percent engaged in day use only or camped in the frontcountry. Of the total number of wilderness visitors 25.4 percent also reported staying in a developed campground (Vande Kamp *et al*. 1999). In the 2000 visitor use survey, 79 percent of visitors reported taking a hike. Of those 89 percent reported hiking near developed areas and 32 percent in wilderness (Simmons *et al*. 2001). When this data is combined with information on the length of hike (shorter than two hours, between two and four hours or more than four hours), 41 percent reported taking a hike shorter than two hours, 44 percent took a hike between two and four hours and 30 percent took a hike longer than four hours, it seems that there may be a lack of understanding about the park wilderness boundary since most hikes longer than two hours would likely have entered wilderness, except perhaps in the Paradise area. (In general, the park wilderness boundary is 200 feet from the centerline of paved roads and edges of developed areas and 100 feet from the centerline of unpaved roads.)

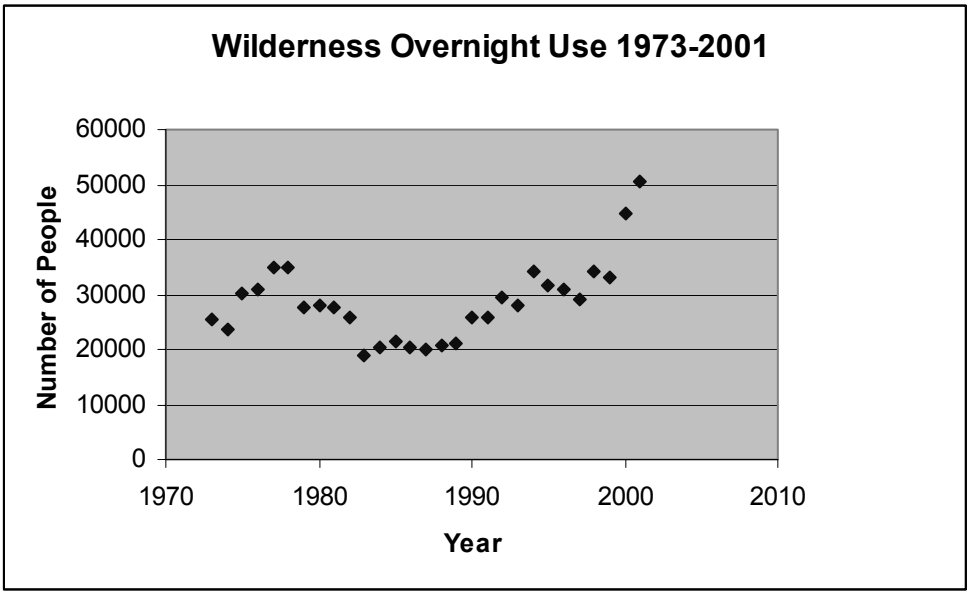
The following table shows the potential maximum allowable overnight wilderness use based on current overnight use limits (derived from the Wilderness Management Plan).

TABLE 11: TOTAL POTENTIAL WILDERNESS CAMP SUMMER VISITOR USE

	Trailside Camps	**Total # of Camp Sites**	**Party Size**	**# Camp Site Nights** (# camp sites x 140 nights in summer)	**# Camper Nights** (# camp sites x 140 nights in summer x party size)
Group sites	25 with at least one group site (Sunrise has 2 group sites)	26	12	3,640	43,680
Individual sites	37 with at least one individual site (average of 3.5 individual sites per trailside camp)	127	5	17,780	88,900
Total		152		21,420	132,580

The following graph shows the trend in the number of user nights over time. This chart includes alpine areas, cross- country areas and designated camps.

Figure 2: Summer Wilderness Overnight Use Trend



The following table based on data from the Wilderness Permit System database shows how many visitors actually stayed overnight in park wilderness in 2001. As noted, this table includes not only backpackers but also climbers (NPS 2002).

TABLE 12: WILDERNESS OVERNIGHT USE 2001 (WINTER VS. SUMMER)
(Designated Camps, Alpine and Cross-Country Areas)

MANAGEMENT AREA	TOTAL USE	Winter (Nov-April) Camper Nights	Summer (May-Oct) Camper Nights
ALPINE AREAS (all upper mountain combined)			
Total Alpine Area Use	**9,754**	**192**	**9,562**
CROSS-COUNTRY AREAS			
Carbon Cross-Country Areas	691	32	659
Longmire Cross-Country Areas	6,058	5,056	1,002
Ohanapecosh Cross-Country Areas	456	0	456
White River Cross-Country Areas	720	8	712
Total Cross-Country Area Use	**7,917**	**5,088**	**2,829**
DESIGNATED CAMPS			
Alpine Camps (includes Camps Muir, Schurman, Hazard, Curtis, Thumb Rock)	17,036	1,613	15,423
Carbon Area (not including Mowich Lake)	6,084	212	5,872
Longmire Area	7,488	190	7,298
Ohanapecosh Area	2,246	58	2,188
White River Area	7,442	140	7,302
Total Designated Camp Use	**40,296**	**2,213**	**38,083**
TOTAL Wilderness Overnight Use	**57,975**	**7,493**	**50,474**

➢ WILDERNESS

Area: In 1988, Congress designated approximately 97 percent (228,480 acres) of Mount Rainier National Park as wilderness. Park wilderness includes a wide array of undisturbed lands encompassing ancient rainforest, pristine rivers and brilliant subalpine meadows. Park

wilderness values include natural, ecological, geological, cultural, scenic, scientific and recreational opportunities. Natural quiet and natural darkness are also considered wilderness values. In the park, the wilderness boundary generally is located 200 feet on either side of the centerline of paved roads and 100 feet from the centerline of unpaved roads.

Natural Resources: Park wilderness offers a wide array of scenic, natural and ecological values. Park wilderness encompasses the full breadth of the diverse Mount Rainier landscape of glacial ice and snow, old growth forests, river headwaters, streams and waterfalls, abundant wetlands and through flower- filled subalpine meadows and rock scree slopes with perennial snow patches. Park wilderness is and has been an ongoing object of scientific study. As the highest active Cascade volcano, exhibiting near- record snowfall and the greatest single- peak glacial system in the continental United States, the Mountain offers outstanding opportunities to understand vegetation, wildlife, fire ecology, catastrophic geologic events – including lahars, glacial outburst floods and volcanic eruptions – snow, ice and other water resources. These resources afford excellent opportunities to study ecosystem structure, function, processes and components across the breadth of this volcanic landscape.

Cultural Resources: Park wilderness cultural resources are also outstanding. As a premier National Historic Landmark District, the best example of NPS planning in the early twentieth century, the park offers an outstanding opportunity to understand park related human impacts as well as an unparalleled collection of rustic architecture and naturalistic landscape architecture. The park's human history is spread over nearly 8,500 years and offers glimpses into the distribution of people across a high mountain landscape over centuries of ecological changes in climate and topography.

Recreational Experiences: Park wilderness also offers a range of recreational experiences – including camping, hiking, mountain climbing, backpacking, photography, picnicking, and a host of winter activities, including snowshoeing, cross- country skiing, sliding and snowboarding.

Use Season: Most wilderness use occurs from June through September, especially on weekends and sunny days. During other months and many summer weekdays (except during the peak season), few people are encountered in the vast majority of the wilderness area (NPS 2002). There remain, despite heavy seasonal visitation, outstanding opportunities for solitude.

GMP Zoning: The Muir and Kautz routes are a high use climbing zone, the Emmons Route is a moderate use climbing zone. As such, they are mountaineering activity landscapes modified by the presence of wilderness appropriate structures. Based on the definition of this zone, there are to be no visible signs of human use off the routes. According to the GMP, the desired visitor experience of the high use zone has a moderate to high degree of social interaction and the moderate use zone has a moderate to low degree of social interaction.

Other areas affected by the alternatives in this plan are primarily pristine, primitive and sensitive resource recreation zones, as well as semi- primitive and transition trails. The following table, taken from the GMP (NPS 2001) identifies the conditions associated with the zone designations.

Management Zone	Desired Resource Condition	Visitor Experience	Facilities and Activities
WILDERNESS ZONES			
Pristine	Essentially untouched environment	The feeling of being alone	Very minimal signs of human use, no trails or designated campsites.
Primitive	Largely natural, unmodified landscape	Opportunities to experience solitude and quiet. The feeling of being apart, but not alone	Minimal signs of human use, except for a few primitive routes and designated campsites in alpine areas.
High Use Climbing	Natural landscape modified by presence of wilderness appropriate structures. No visible signs of human use off the routes.	Moderate to high degree of social interaction and few opportunities for solitude.	A few wilderness appropriate structures such as primitive routes and designated campsites. Activities oriented toward mountaineering.
Moderate Use Climbing	Similar to the high use	Moderate to low degree of	Similar to the high use

	climbing zone.	social interaction and more opportunities for solitude	climbing zone
Semi-primitive Trail	Natural landscape modified by presence of wilderness appropriate structures.	Wilderness experience with occasional periods of solitude.	Designated trails, camps and other wilderness appropriate structures. Activities oriented toward hiking.
Transition Trail	Same as Semi-primitive Trail.	Wilderness hiking experience with a high degree of social interaction and few opportunities for solitude.	Same as the semi-primitive zone, but with greater evidence of human use.
NON-WILDERNESS ZONES			
Sensitive Resource Recreation		Experience of park resources generally unimpeded by other visitors and relatively close to developed facilities. A high degree of social interaction.	Facilities and structures in localized areas. Hiking would be the primary activity.

Limits: Since 1973 overnight camping use limits have been used to regulate the size, number and location of overnight wilderness visitors to protect wilderness resources. (Prior to 1973, backcountry use was unlimited and camps were undesignated.) Since the 1989 revision to the Wilderness Management Plan, a modified Limits of Acceptable Change (LAC) system has been used to identify resource impacts in park wilderness. LAC is a planning framework developed by Stankey *et al.* 1985 to establish acceptable and appropriate or desirable resource and social conditions (factors) in recreation settings. In Mount Rainier, the limits of acceptable change were described for major resource and social condition ("factors"). "Standards" were developed using the best available knowledge about park wilderness and were expected to be reviewed annually and refined periodically. For each standard, a series of "indicators" were developed that include the variables measured to detect the state or condition of the resources and to enable assessment of whether the resource is in or out of standard.

Wilderness staff report human impacts on park resources as well as non- compliance with regulations. Initial data included analysis of yearly trends and levels of compliance with regulations, as well as determination of the need for restoration. When the condition of an area has been altered by human use to a degree that makes natural recovery unlikely, corrective actions are proposed. Restoration may include covering an area with brush to discourage use, to scarification, reseeding and/or limitations on use or closure of the area until recovery occurs.

Party Size: Party size in wilderness is limited to 12 or fewer overnight visitors. Use of cross-country areas is limited to five or fewer overnight visitors. There are currently no limits on day use party sizes.

Management Areas: In addition to the GMP zoning, the Wilderness Management Plan (National Park Service 1989) uses management areas to enable operational efficiency in management. WMP areas include trail, cross- country and alpine areas. The park contains 37 designated trailside camps, 41 cross- country areas, and 19 alpine areas (including 4 alpine camps), each with varying limits for overnight use (described in the 1973 Backcountry Management Plan and Environmental Assessment and 1989 Wilderness Management Plan as amended). As shown in Table 11 above, 37 trailside camps contain 25 group sites and 127 individual sites. The cross- country areas have limits that specify the number of parties or the allowable number of people and vary from one to five parties (5 to 25 people in summer, 12- 60 people in winter). Three relatively large areas, comprising approximately 41 percent of the park remain unlimited with respect to overnight camping. The alpine areas, including Camps Muir, Schurman, Curtis and Hazard, have similar overnight limits – from two parties to 110 people. (**See Wilderness Management Zones Map**). In addition, there are a number of no camping areas and zones, including any location within ¼ mile of a designated trail or road, the Butter Creek Research Natural Area, and the Paradise, Sunrise/Burroughs Mountain and Longmire areas in summer.

These limitations have allowed a large number of visitors to camp in the park, while protecting the resources they come to enjoy. Through the limits, impacts are concentrated into durable trailside and alpine camps, while dispersing use among the cross- country and alpine areas and increasing opportunities for solitude.

Encounters: A 1999 summer visitor use survey of wilderness visitors identified 53.2 percent of wilderness visitors seeing the same number of other people that they expected to see. Twenty-two percent, however saw more people than they expected and nearly 20 percent saw fewer people than they expected. Five percent had no expectations (Vande Kamp *et al.* 1999). More respondents at Comet Falls and Mount Fremont saw the number of people they expected, while the largest number of respondents at Glacier Basin reported seeing more or a lot more people than they expected and more respondents to Summerland saw less or a lot less than expected. The same study found "slightly crowded" (3.5) as the mean degree of crowding on a scale of 1 (not at all crowded) to 9 (extremely crowded). When this information was compared for weekends versus weekdays, little or no crowding was reported on weekdays and moderate crowding was reported on weekends (Vande Kamp *et al.* 1999).

Experience: This same study (Vande Kamp *et al.* 1999) found that only about 40 percent were aware of the area's wilderness designation and that most visitors sampled (75.9 percent) expected a scenic rather than a wilderness experience (15.8 percent). When compared to the actual experience, most visitors (71 percent) had the type of trip they expected. Forty- one percent expected a wilderness trip, but had a scenic trip and 21.8 percent expected a scenic trip, but had a wilderness trip (Vande Kamp *et al.* 1999).

Resource Impacts: The 1999 study also examined the types of damage to park resources by park visitors. Categories included: off- trail hiking or social trails, trash/litter, unspecified erosion, and other. Nineteen percent of visitors reported unacceptable damage. Of this percentage, most (57.5 percent) saw off- trail hiking or social trails, 20.8 percent saw trash/litter, and 9.4 percent saw unspecified erosion. Another 12.2 percent saw something else unacceptable.

When the data regarding crowding (encounters) and resource damage were compared collectively, degree of crowding accounted for 29 percent of the difference in expected versus actual type of trip and resource damage accounted for nearly 20 percent of the difference (Vande Kamp *et al.* 1999).

Climbing Route Marking: During a typical mid- season climb up most well- used routes, climbers will find the route marked by the steps and wands (garden bamboo poles about 3 feet tall, often with colored tape on top) of those who have gone before. Snow compaction by climbers traveling in a line routinely occurs on well- used routes. In the winter route marking with wands above the high camps is a standard practice. Ideally, the wands are placed during the ascent and removed during descent. Climbers also use other route aids, including crevasse ladders and ropes on steep slopes. The Disappointment Cleaver Route has historically contained a wide variety of climbing aids, including hundreds of feet of fixed rope, ladders and wands, primarily placed by the concessioner in consultation with the park. Compared to the Disappointment Cleaver Route, the Emmons, Kautz and Other routes have historically restricted use of route aids. In general, route aids are not permitted in wilderness, however, active management of these has lapsed due to limited staff and no formal system for approval.

Current Use of Mechanized Equipment: Administrative use of mechanized transport and equipment is limited to essential resupply and repair of high camps, removal of human waste, search and rescue, and maintenance and repair of trails, and survey and rehabilitation of natural and cultural resources when it has been determined that mechanized methods are the minimum requirement/tool for wilderness.

Administrative Improvements: These include signs, patrol cabins, trail shelters, fire lookouts, toilets, approximately 37 designated camps with site markers and access trails and a system of over 300 miles of designated trails containing culverts, bridges, puncheon, rock and log- lining and other historic and non- historic constructed features. Over time, there have been changes in the number of wilderness camps, the number of sites (including individual and group sites), the type of toilet and its location and the location of the camps.

Human Impacts (See also Water Resources and Vegetation): Human impacts in wilderness can occur from visitors traveling through or camping in sensitive areas, or from the removal or placement of waste or objects. Programs such as *Leave No Trace*, train wilderness visitors to take nothing from wilderness and to leave nothing behind – including, food, waste, gear, or garbage. This program encompasses ensuring that wilderness visitors avoid the creation of tent platforms, campfires, wind blocks, shelters, and that they minimize their impact on area vegetation by staying and traveling on snow and other well- traveled or hardened surfaces as much as possible.

➢ PARK OPERATIONS

Administration: Current commercial service agreements, which authorize commercial services within Mount Rainier National Park include:

- **Concession contracts** for visitor services determined to be necessary and appropriate. They allow business transactions to take place within the park. Contracts may involve a land or facility assignment in the park.
- **Incidental Business Permits** (IBPs), which will soon be replaced with Commercial Use Authorizations (CUAs), authorize other commercial activities, such as guiding and instructional services, determined to be appropriate. Services authorized by an IBP must begin and end outside the park boundary. Most activity permitted through the use of CUAs will begin and end outside the park boundary as well, however a new in- park CUA has been proposed, which will allow for certain activities within the park boundary. In park CUAs may not general more than $25,000 per year, but this income limit does not apply to CUAs offering services that begin and end outside the park boundary.
- **Special Use Permits** (SUPs) authorize park uses identified under the following sections in the Code of Federal Regulations 2.50 Special Events, 2.51 Public assemblies and meetings, and 2.52 Sale or Distribution of Printed Matter. Some examples of these are religious services, weddings and the scattering of ashes. Mount Rainier has a unique special use permit that applies to climbers ascending the mountain above 10,000 feet or glacier travel. Other guidance found in Section 8.6.1 states: "Special events. . .may be permitted by the Superintendent when 1) there is a meaningful association between the park area and the event, and 2) the event will contribute to visitor understanding of the significance of the park area."
- **Commercial Filming Permits** are issued for requests that do not adversely affect park resources or visitor experience. These permits are regulated under 43 CFR, Part 5: Making Pictures, Television Productions or Sound Tracks on Certain Areas under the Jurisdiction of the Department of the Interior and under 36 CFR 5.5 Commercial Photography.

The current commercial services program includes 3 concession contracts and 16 IBPs. There is an intense degree of interest by providers of commercial services, as evidenced by the number of inquiries for park commercial services. Each year, the park approves 5- 10 commercial filming permits and more than 60 SUPs. Approximately one- third are for weddings, one- third for spreading ashes, and the others are for a wide variety of activities from military and FBI training, mountaineering/rescue training, first amendment activities, car rallies, bicycle events and still photography.

The following sections from *Management Policies* (NPS 2001) pertain to the management of commercial services in the park:

- Concession operations will be evaluated to ensure that park visitors are provided with high quality services and facilities, which are safe and sanitary, and meet NPS environmental, health, safety and operational standards (10.2.4.3).
- Concessioners will be encouraged to train their employees and, through their facilities and services, to instill in their guest an appreciation of the park, its purpose and significance , its proper and sustainable management, and the stewardship of its resources. . . Concession contracts will require the concessioner to provide all visitor services in a manner that is consistent with, and supportive of, the park interpretive themes, goals and objectives

articulated in each park's planning documents, mission statement, and/or interpretive proposals (10.2.4.4).

- Concession contracts require each concessioner to develop a risk management program, approved by the superintendent. . . responsible for managing all their operations in a manner that minimizes risk and controls loss due to accident, illness or injury (10.2.4.8).
- Contracts require concessioners to be responsible for all maintenance and repair of facilities, lands and utility systems assigned for their use, in accordance with standards acceptable to the NPS (10.2.6.3).

In addition, the Cost Recovery Act (16 USC 3a) requires the NPS to recover the costs of providing services to business permittees authorized under IBPs or CUAs. The Money and Finance portion of the U.S. Code Fees and Charges for Government Services and Things of Value (31 USC 9701) provides an even strong mandate to recover costs. The cost is defined as the amount expended by the agency in accommodating the use. It includes the cost of processing and administering the permit and of monitoring the activity for compliance with conditions. Administration costs can be averaged, but monitoring costs must be itemized, actual costs.

The 1998 Concessions Act created CUAs. Implementing regulations (36 CFR 52) are currently being reviewed . Section 418 (b) 2.D of the 1998 Act prohibits the National Park Service from issuing ". . . more authorizations than are consistent with the preservation and proper management of park resources and values." It also states that the NPS "shall establish such other conditions. . . appropriate for the protection of visitors. . . and proper management of the resources and values of the park." Section 418(b)2.B notes that authorized services ". . .must be accomplished in a manner consistent to the highest practicable degree with the preservation and conservation of the park resources and values."

Public Health and Safety: All commercial service providers are also required to follow various applicable laws and regulations (such as OSHA regulations and the Safe Drinking Water Act as well as other environmental laws). Commercially guided parties are required to follow public health requirements outlined in Reference H of Reference Manual 83: Backcountry Sanitation Guidelines and the Food and Drug Administration Food Code. Concessioners must follow specific safety and loss control requirements. IBP holders are required to follow specific safety requirements identified in their permit conditions as well as other applicable safety and health requirements (29 CFR, Washington State L & I regulations, etc).

The high level of technical mountaineering needed to climb Mount Rainier requires that climbers have or obtain appropriate skills before attempting the summit. Glaciated slopes, lightning, ice and rock fall, white- outs, crevasse crossings and inclement weather make the Mountain an extreme and dangerous challenge. Climbing deaths on Mount Rainier have resulted from extreme weather conditions, hypothermia, rockfalls, collapsing snowbridges, roped and unroped slides into crevasses, high altitude pulmonary edema, avalanches, glissading, equipment failure, snow asphyxiation, and unauthorized solo climbs. Other variables include climber training, preparation, conditioning, and decision- making. Cold weather and conditioning factors, such as frostbite, hypothermia, dehydration and altitude sickness can also be contributing factors. From 1897- June 2003, there were 43 climbing related fatalities on Mount Rainier. During the same period, there were 38 hiking related fatalities. National Park Service statistics indicate that climbers are more likely than other park visitors to be killed or seriously injured (Gauthier 1999).

There is year- round public emergency radio access at Camps Muir and Schurman. Many climbers and hikers also carry cellular or satellite phones, however, their ability to transmit on the Mountain is highly unreliable, dependent on local conditions. Every year, there are numerous were search and rescue attempts. These involved climbers, hikers and other front- country users.

➢ SOCIOECONOMIC ENVIRONMENT

The area affected by park operations and visitor activities includes parts of four counties, where there has been a moderate, but steady increase in population over many years. As urban areas begin to move ever closer to the park's boundary, commercial businesses are increasing in gateway communities. As noted in the park GMP, growth in the four county area (King, Pierce, Lewis and Yakima) is expected to continue to increase over the next 20 years.

While the park is a primary destination for visitors to the Pacific Northwest, it is only one of among many attractions, including other national parks. There are a large number of regional recreational opportunities in the vicinity of the park. The gateway communities of Elbe and Ashford, Packwood, Wilkeson and Carbonado, Greenwater and further out, Enumclaw and Eatonville surround the park. While not as tourist- oriented as some national park gateway communities, increasingly there are businesses in these communities that cater to recreational tourism. Lodging opportunities, with a wide variety of motels, bed and breakfast establishments and recreational vehicle parks are widely available in many of these communities. In addition, food and gift services and recreational businesses continue to grow.

Within the park, concessions authorizations and incidental business permits (which will be replaced by commercial use authorizations as a result of the 1998 Concessions Act) are used to manage commercial services. The park currently has three concession authorizations and 25 incidental business permits. See the *Commercial Services Plan* document for more information.

While these commercial operations are not exclusively supported by the park, many are integral parts of the small town economies in communities surrounding the park and during the peak season employ and high number of staff. Compared to regional economies, these are small economic opportunities and contribute more to gateway communities than to regional economies. As more park operations move outside the park and as more services in gateway communities arise, visitors attracted to the park continue to find more reasons to stop along the way. For example, Eatonville has developed a community vision and plan for improving its main streets to capture more economic benefits from tourism.

Visitors contribute to the park and local economies by spending money within and outside the park. The 2000 visitor use survey (Simmons *et al.* 2001) identified the following expenditures related to a variety of activities in and outside the park:

- 27 percent: hotels, motels, cabins, bed and breakfasts, etc. (11 percent in the park)
- 19 percent: restaurants and bars (48 percent in the park)
- 16 percent: all other purchases (58 percent in the park)
- 13 percent: other transportation expenses (2 percent in the park)
- 7 percent: gas and oil (not available in the park)
- 7 percent: admissions, recreation, entertainment fees (68 percent in the park)
- 6 percent: groceries and take- out food (21 percent in the park)
- 5 percent: camping fees (21 percent in the park)

On average, during the survey period, visitors spent $69.00 on their visit. Forty- three percent of visitors spent up to $50.00, 18 percent spent from $51.00 to $100.00, eight percent spent between $101.00 and $150.00 and twelve percent spent $351.00 or more. Six percent spent nothing.

V. ENVIRONMENTAL CONSEQUENCES

Methodology

The environmental consequences for each impact topic were defined based on the following information regarding context, type of impact, duration of impact, area of impact and the cumulative context.

All Impacts

Context: Setting within which impacts are analyzed – such as the project area or region.

Type of Impact

Beneficial: Reduces impact being discussed.
Adverse: Increases or results in impact being discussed.

Direct: Caused by and occurring at the same time and place as the action
Indirect: Caused by the action, but occurring later in time at another place or to another resource.

Duration of Impact

Short-term: Associated with a specific event, less than five years
Long-term: Occurs continuously based on normal activity or for more than five years.

Area of Impact

Localized: Detectable only in the vicinity of the activity
Widespread: Detectable on a landscape scale

Cumulative

Context: Cumulative impacts are the effects on the environment that would result from the incremental impacts of the action when added to other past, present and reasonably foreseeable future actions. Impacts are considered cumulative regardless of what agency or group (federal or non- federal) undertakes the action.

Soils, Vegetation, Wildlife, Visitor Experience, Wilderness and Park Operations Impacts

Intensity of Impact

- **Negligible**: Measurable or anticipated degree of change would not be detectable or would be only slightly detectable.
- **Minor**: Measurable or anticipated degree of change would be have a slight effect, causing a slightly noticeable change of approximately less than 20 percent compared to existing conditions.
- **Moderate**: Measurable or anticipated degree of change would be noticed by most people and would likely be between 21 and 50 percent compared to existing conditions.
- **Major**: Measurable or anticipated degree of change would be substantial, causing a highly noticeable change of approximately greater than 50 percent compared to existing conditions.

Special Status Species

Intensity of Impact

- **No Effect** — The project (or action) is located outside suitable habitat and there would be no disturbance or other direct or indirect impacts on the species. The action will not affect the listed species or its designated critical habitat (USFWS 1998).
- **May Effect, Not Likely to Adversely Effect** — The project (or action) occurs in suitable habitat or results in indirect impacts on the species, but the effect on the species is likely to be entirely beneficial, discountable, or insignificant. The action may pose effects on listed species or designated critical habitat but given circumstances or mitigation conditions, the effects may be discounted, insignificant, or completely beneficial. Insignificant effects would not result in take. Discountable effects are those extremely

unlikely to occur. Based on best judgment, a person would not 1) be able to meaningfully measure, detect, or evaluate insignificant effects or 2) expect discountable effects to occur (USFWS1998).

- **May Effect, Likely to Adversely Effect —** The project (or action) would have an adverse effect on a listed species as a result of direct, indirect, interrelated, or interdependent actions. An adverse effect on a listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions and the effect is not: discountable, insignificant, or beneficial (USFWS 1998).

Archeology/Ethnography/Historic Structures/Cultural Landscapes

Intensity of Impact

- **No Effect**: The action will not affect a historic property or the characteristics of a property that may qualify it for inclusion in the National Register of Historic Places. The action would also not, based on conditions of approval, likely result in impacts to presently unidentified cultural resources.
- **No Adverse Effect**: An undertaking has an effect on a historic property when the undertaking may alter characteristics of the property that may qualify the property for inclusion in the National Register (FR 51:169 1986). For example, the action may result in diminishing the character- defining features or aspects of a historic structure that make it eligible for the National Register, but the actions are consistent with the Secretary's Standards for the Treatment of Historic Properties.
- **Adverse Effect**: An undertaking is considered to have an adverse effect when the effect on a historic property may diminish the integrity of the property's location, design, setting, materials, workmanship, feeling or association(FR 51:169 1986). In other words, the effects on character- defining features or aspects of a historic structure would result in diminishing or removing the characteristics that make it eligible for the National Register of Historic Places and as a result would not be consistent with the Secretary's Standards for the Treatment of Historic Properties.

ASSUMPTIONS

Contribution of Commercial Use: What portion of impacts are related to overnight commercial use, what portion are related to overnight independent use and what portion are related to day use has not been determined for impacts on most resources. It can be surmised, however, that:

- since concession and CUA- led groups have certain permit conditions they must adhere to in order to retain their permit, and
- since the percentage of commercially guided visitors in most areas of the park is usually far less than 30 percent* of total use (except on the Muir Route, where it is nearly 50 percent of the total use)

that (depending on the area) the contribution to resource impacts from commercially guided groups is generally lower than and likely does not contribute significantly to impacts associated with day use and non- guided visitors.

* *the historic practice has been to limit climbing commercial use (when identified as such) to approximately 30 percent of total use*

Establishment of Use Limits: Because of the moratorium there is little data on the desirability of some commercial services determined appropriate. Therefore the initial limits identified in the plan for these services are based on assumptions related to recent requests for similar services as well as other factors, including the park's ability to manage them. Since CUAs for these services would be granted for a period of from one to several years and would operate under certain conditions or stipulations, including use limits, locations dates and times, future opportunities to modify the limits associated with these services would be available upon a finding that previously unidentified or unacceptable adverse resource impacts were occurring.

Update to Wilderness Management Plan/Carrying Capacity Plan: The analysis as presented below is based on the assumption that revisions to the Wilderness Management Plan would be made within 5 years or that a Carrying Capacity Plan would be written as called for by the GMP and that

these plans would likely reduce the effective carrying capacity of park wilderness management areas. The existing Wilderness Management Plan overnight use limits were originally based on existing use and an understanding of the physical carrying capacity of camps, cross- country areas and alpine areas as well as on decisions made in response to two lawsuits. As a result, while this plan proposes limits on commercial visitor use that are based on current understanding of resource impacts and ways to avoid, minimize or mitigate them, additional future regulation of independent visitor use limits may be necessary (as noted in the park GMP) that would further reduce existing impacts to park resources and would further minimize the potential for these future impacts to be caused by minimally regulated independent visitors, against a background of more regulated commercial visitors.

IMPACT COMPARISON CHART
Guided Climbing

Variable	Guided Climbing Alternative 1	Guided Climbing Alternative 2	Guided Climbing Alternative 3	Guided Climbing Alternative 4
Air Quality	Common to All Impacts: Negligible to minor adverse impacts from delivery of supplies, vehicle use for commercial operations, propane stoves, snow melt water system, and transport of commercial visitors. Specific Impacts: Negligible beneficial impacts from some use of shuttles by concessioner and IBPs. Long-term minor increase in air quality effects from increased number of clients/CUAs on several routes.	Common to All Impacts from Alternative 1 plus: Initial negligible increase from more commercial climbers over 2001, followed by long-term beneficial impact from use of shuttles and client cap over potential in Alternative1. Negligible decrease from increased use of shuttles and cessation of helicopter transport of supplies for concessioners.	Same as Alternative 2.	Same as Alternative 2, but fewer climbers would result in fewer impacts.
Water Quality	Common to All Impacts: Negligible to minor impacts when suggested Leave No Trace and other mitigation strategies are followed. Minor to moderate localized impacts where not employed. Specific Impacts: Increasing minor impacts from increased number of people (CUAs) and consequent potential increase in non-compliant behaviors.	Common to All Impacts from Alternative 1 plus: Initial negligible increase from increase in number of commercial visitors over 2001, followed by long-term beneficial impact from required use of strategies to avoid, minimize or mitigate impacts. Continued minor to moderate localized impacts from non-compliant behaviors. Long-term minor beneficial impact from new toilet at Camp Schurman.	Same as Alternative 2, but with slightly more commercial visitors accommodated.	Same as Alternative 2, but with fewer commercial visitors accommodated.
Geological Hazards	Negligible to major potential for geological hazards to occur unaffected by Alternatives. Moderate additional number of commercial visitors exposed to existing and potential hazards.	Negligible to major potential for geological hazards to occur unaffected by Alternatives. Moderate additional number of commercial visitors exposed to existing and potential hazards. Negligible long-term beneficial impacts from required geological hazards orientation for guides and clients that would result in better informed commercial visitors.	Same as Alternative 2	Same as Alternative 2.
Soils and Vegetation	Potential for increase in both commercial and independent climbing use leading to some potential for localized impairment of alpine areas, moderate to major impacts to subalpine	Initial negligible to minor increase in impacts from slight increase in number of commercial visitors over 2001, followed by long-term beneficial impact from cap and required use of strategies to	Same as Alternative 2 except: Negligibly more impacts from slightly more commercial	Same as Alternative 2 except: Minor reduction in number of commercial visitors.

Variable	Guided Climbing Alternative 1	Guided Climbing Alternative 2	Guided Climbing Alternative 3	Guided Climbing Alternative 4
	areas, and negligible to moderate impacts to forested areas if use continues to increase. Negligible to moderate impacts attributable to commercial visitors during melt-out from trampling of emerging vegetation and confusion related to undesignated routes at the end of maintained trails. Potential for major impacts if use increases. Continued localized minor to moderate trampling and other impacts in sensitive areas from cross-country use. Highest potential use and impacts to park wilderness by commercial visitors with increased number of people/user nights/CUAs.	avoid, minimize or mitigate impacts. Long-term moderate to major beneficial effects coupled with negligible to minor adverse effects by designating more routes and campsites and requiring commercial visitors to use standard approach routes, etc. Short-term beneficial impact coupled with long-term minor to major adverse effect attributed to cap on commercial climbing against a background of increasing independent climbers. Elimination of commercial overnight use of Muir snowfield could have negligible to moderate adverse effect regarding rule compliance and a moderate beneficial impact by reducing and not replacing (with independent use) the activity that causes the most impacts to sensitive surrounding areas. Future potential for major impacts prevented by seasonality of some climbing routes, development of revised Wilderness Management Plan and/or Carrying Capacity implementation and the small contribution of commercial use compared to independent use.	climbing use. Fewer potential impacts in sensitive areas from designation of more commercial free areas.	Fewer potential impacts in sensitive areas from designation of more commercial free areas (though less than Alternative 3).
Wildlife	<u>Common to All Impacts</u>: Negligible to moderate localized adverse effects associated with the predictable rise and fall of human activity throughout park developed areas (3 percent) plus maintained trails (primarily high and moderate use trails and routes). Overall negligible to minor effects (primarily disturbance) on wildlife from commercial use and administrative helicopter use. Minor to moderate impacts (trampling) on wildlife habitat in alpine and subalpine areas. <u>Specific Impacts</u>: Highest potential number of user nights and	Common to All Impacts from Alternative 1 plus: Initial negligible to minor increase in impacts from increase in number of commercial visitors over 2001, followed by long-term beneficial impact from cap in use and required strategies to avoid, minimize or mitigate impacts. Minimal effects (such as trampling) on wildlife habitat with most commercial use continuing to occur in or near developed areas and on designated trails and routes. Minor adverse impacts from designation of additional segments of trails and campsites coupled with long-term beneficial impacts from the same action by reducing the number of social	Negligible to moderate impacts similar to Alternative 2. Negligible beneficial effect from greatest number of commercial free areas. Second highest number of user nights and people that could disturb wildlife.	Negligible to moderate impacts similar to Alternative 2. Negligible benefit from smaller number of commercial free areas. Lowest number of user nights and people that could disturb wildlife. Negligible impacts from slight additional use of Emmons Route.

Variable	Guided Climbing Alternative 1	Guided Climbing Alternative 2	Guided Climbing Alternative 3	Guided Climbing Alternative 4
	people that could disturb wildlife and cause continued habituation, displacement and direct or indirect harm.	trails (and similar causes of habitat destruction). Second lowest number of user nights and people that could disturb wildlife.		
Special Status Species	Minimal effects due to the distance of commercial activities from known nesting areas. Not likely to adversely affect northern spotted owls and marbled murrelets during nesting season (March – September) and no effect during other times (October – February). Lynx, gray wolf: Not likely to adversely affect. Grizzly, Pacific fisher, wolverine, fish, bald eagle, peregrine falcon, amphibians: No effect			
Prehistoric/Historic Archeology	No adverse effect.	No adverse effect. Minimal potential for effects from grading and vegetation removal along Westside Road, creation of designated trails from braided social trails, etc.	Same as Alternative 2.	Same as Alternative 2.
Ethnography	No effect.	No effect	No effect	No effect
Historic Structures **Cultural Landscapes**	No adverse effect.	No adverse effect. Long-term beneficial effect from removal of Gombu/client shelter.	Same as Alternative 2.	Same as Alternative 2.
Visitor Experience	Long-term minor to moderate impact to visitor access as the ratio of independent visitors decreased against a background of increasing commercial use. Minor to major effect on visitor access during sunny summer days. Moderate adverse effect on visitor use opportunities and access to park wilderness. Minor to moderate, localized adverse effect on the quality of the visitor experience (in terms of number of impacts noticed). Minor beneficial effects on visitor use opportunities from new or expanded CUAs. Long-term beneficial effect from continued regulation of visitor use.	<u>Common Impacts Alternatives 2-4</u>: Short- and long-term beneficial effects from suite of required strategies that would collectively avoid, minimize or mitigate visitor use impacts on park resources and improve the overall visitor experience by minimizing the resource impacts noticed by visitors, thereby minimizing encounters with other visitors, while expanding opportunities for new services. Long-term beneficial effect on visitor enjoyment from increased sharing of knowledge about reducing resource impacts to guided groups. Long-term beneficial effect on commercial and independent visitors by establishing minimum client to guide ratios that could increase the safety margin associated with guided groups. Long-term beneficial effect from establishing initial	Common to All Impacts from Alternative 2 plus: Moderate beneficial effect on visitor opportunity from great degree of competition and choice on all routes. Negligible beneficial effect on visitor access from expanded opportunities (Single Trip Guides). Negligible to moderate beneficial or adverse effects on commercial and independent visitors from commercial free times and zones.	Common to All Impacts from Alternative 2 plus: Negligible adverse effect on visitor use opportunity from maintaining degree of competition and choice on Muir and Other routes and decreasing it on Emmons Route. Negligible beneficial effect on visitor access from expanded opportunities (Single Trip Guides). Negligible to moderate beneficial or adverse effects on commercial and independent visitors from commercial free

Variable	Guided Climbing Alternative 1	Guided Climbing Alternative 2	Guided Climbing Alternative 3	Guided Climbing Alternative 4
	Least degree of competition and choice in guided climbing vendors, except on Emmons Route, where expanded CUAs would result in a minor beneficial effect on visitor opportunities. Moderate beneficial effect from greatest potential for expansion of types concessioner-offered climbing activities.	limits for commercial activities, better tracking of services, and required resource training for guides (and therefore clients). Long-term beneficial effect from establishing limits, thereby benefiting park resources and increasing the number of areas where visitors find resources in good condition. Minor adverse effect on commercial visitors and long-term beneficial effect on independent visitors by restricting commercial groups to any one camp or zone. Beneficial effect by increasing the number of concessioners or CUAs, thereby increasing the potential to foster competition and choice among vendors. Negligible to moderate adverse or beneficial effect from increasing the range of new or expanded commercial activities depending on whether the effect was on other independent or commercial visitors. <u>Specific Impacts</u>: Moderate beneficial effect from increased competition on Emmons Route. Negligible to minor beneficial effect from Increased flexibility to offer longer summit climbs. Negligible to moderate beneficial or adverse effects on commercial and independent visitors from commercial free times. Moderate beneficial effect by increasing the number of people and trips on many climbing routes. Long-term beneficial effect by holding Muir Route usage at about the same level as 2001. Negligible adverse effect from concessioners not	Minor beneficial effect by increasing the number of people and trips on available climbing routes. Long-term beneficial effect by holding Muir Route usage at about the same level as 2001.	times and zones. Minor adverse effect by decreasing the number of people on the Muir Route. Long-term beneficial impact on independent visitors by reducing commercial Muir Route use.

Variable	Guided Climbing Alternative 1	Guided Climbing Alternative 2	Guided Climbing Alternative 3	Guided Climbing Alternative 4
		being able to offer separate mountaineering day school to each client combined with beneficial effect from potential for increased collaboration among park commercial service providers.		
Wilderness	Common to All Impacts: Helicopter use for search and rescue operations, spring and fall waste removal and resupply of high camps would continue to have a moderate short-term adverse effect. Negligible to minor adverse effects associated with maintenance of high camps surrounded by wilderness. No effect on primitive, unconfined recreation and physical and mental challenge. No effect on opportunities for scientific study, etc. No adverse effect on wilderness cultural resources values. Continued minor to moderate beneficial effect from preservation of cultural resources values in wilderness, particularly associated with the Mount Rainier National Historic Landmark District. Specific Impacts: Negligible to moderate effect on summer solitude associated with various trails and trail segments as expansion of the type and range of CUAs in wilderness occurred. Potential minor to moderate effect on increasing commercial compared to independent visitors. Moderate adverse effect on day and overnight experience of solitude from major expansion in the type and range of commercial services in wilderness.	Same as Common to All Impacts from Alternative 1 plus: Common to All Impacts Alternatives 2-4: Negligible to moderate effect from eliminating weekend use of some popular overnight camps. Negligible beneficial effect by discontinuing concessioner resupply flights to Camp Muir. Minor beneficial effect from adopting a process (including conducting requisite environmental analysis) to determine the need for climbing route marking and other route improvements. Negligible effect on primitive, unconfined recreation from increasing the number of commercially guided groups. Negligible adverse effect by increasing the number of designated trail segments and campsites. Negligible to minor beneficial effect on not affecting the condition of park resources thereby improving the ability to enjoy primitive, unconfined recreation by implementation of the strategies to avoid, minimize or mitigate resource impacts. Minor to moderate beneficial impact on opportunities for scientific study, education, stimulation and inspiration from minor to moderate expansion in the types and number of opportunities for commercial visitors to learn more about the park. Negligible effect on summer solitude from slightly increasing the number of commercial use visitors compared to independent use.	Common to All Impacts from Alternative 2 plus: Negligible to moderate effect from eliminating weekend use of some popular overnight camps (commercial free times) and eliminating commercial use of some climbing routes altogether.	Common to All Impacts from Alternative 2 plus: Moderate reduction in the contribution of commercial use to effect on wilderness solitude on Muir Route.

Variable	Guided Climbing Alternative 1	Guided Climbing Alternative 2	Guided Climbing Alternative 3	Guided Climbing Alternative 4
	No effect on Muir and Kautz route GMP definition of solitude ("high use climbing route") but continued moderate to major effect on experience of solitude. Moderate to major adverse impact on Emmons Route GMP definition of and experience of solitude (moderate use climbing route) in summer.	Specific Impacts Alternative 2: Minor beneficial effect from additional introduction of commercial free times on some climbing routes. Negligible to minor effects on solitude associated with increases in commercial visitors compared to independent visitors (minor increases on Muir Route and moderate to major changes on Emmons, Kautz and Other routes). Continued major contribution of commercial use to effect on wilderness solitude on Muir Route. Minor to moderate contribution of commercial use to wilderness solitude on Emmons, Kautz and Other Routes.		
Park Operations	Minor to moderate adverse impact as the number of permits continued to grow, but the time or staff allotted did not. Negligible to moderate effect from managing the distribution of increasing numbers of CUAs.	Common to All Impacts Alternatives 2-4: Long-term beneficial impact on park operations from increasing revenue associated with managing commercial operations. Minor to moderate adverse effect on park operations if additional time and staffing needed to manage more commercial operations were not allocated. Long-term beneficial effect from establishing limits on existing and new commercial services. Negligible to minor beneficial effect from establishing minimum client to guide ratios on increasing public safety. Specific Impacts Climbing Alternatives: Long-term minor beneficial and minor adverse impacts from locating a new toilet and perhaps storage at Camp Schurman. Long-term negligible to minor adverse effect from	Same as Alternative 2.	Same as Alternative 2.

Variable	Guided Climbing Alternative 1	Guided Climbing Alternative 2	Guided Climbing Alternative 3	Guided Climbing Alternative 4
		increasing climbing on the Emmons Route on White River Road snow removal operations, depending on snow conditions.		
Socioeconomic Environment	Minor beneficial impact from revenue associated with climbing concessions.	After Alternative 1, second greatest degree of revenue and least economic feasibility for concessions.	After Alternative 1, highest degree of revenue and highest range of economic feasibility.	After Alternative 1, least degree of revenue and middle range of economic feasibility.

IMPACT COMPARISON CHART
Guided Wilderness

Variable	Guided Wilderness Alternative 1	Guided Wilderness Alternative 2	Guided Wilderness Alternative 3	Guided Wilderness Alternative 4
Air Quality	Common to All Impacts from Guided Climbing Alternative 1 (above) plus: Current negligible impacts from transport of clients could increase to minor with increased number of CUAs. Operational limitations could reduce impacts.	Similar to Guided Climbing Alternative 2.	Additional negligible decrease in air quality impacts over Alternative 2 with decrease in number of trips on Other Routes.	Negligibly fewer impacts from fewer commercial visitors and user nights less than Alternative 3.
Water Quality	Same as Guided Climbing Alternative 1.	Initial negligible increase from increase in number of clients over 2001 baseline, followed by long-term decrease due to client cap over potential in Alternative1, and required use of strategies to avoid, minimize or mitigate impacts. Minor to moderate impacts from small group cross-country travel in summer. Continued minor to moderate localized impacts from non-compliant behaviors.	Same as Alternative 2 but fewer clients and no cross-country commercial group impacts.	Negligible impacts from fewer user nights similar to Alternative 3.
Geological Hazards	Same as Guided Climbing Alternative 1.	Same as Guided Climbing Alternative 2.	Same as Alternative 2.	Same as Alternative 2.
Soils and Vegetation	Highest potential use and impacts to park wilderness by commercial visitors with increased number of CUAs. Negligible to minor localized impacts in forested areas and minor to moderate in subalpine areas. Negligible to moderate impacts attributable to commercial visitors during melt-out from trampling of emerging vegetation and confusion related to undesignated routes at the end of maintained trails. Continued localized minor to moderate trampling and other impacts in sensitive areas from cross-country use.	Initial negligible to minor increase in impacts from slight increase in number of commercial visitors over 2001, followed by long-term beneficial impact from cap and required use of strategies to avoid, minimize or mitigate impacts. Long-term moderate to major beneficial effects coupled with negligible to minor adverse effects by designating more routes and campsites and requiring commercial visitors to use standard approach routes, etc. Short-term beneficial impact coupled with long-term minor to major adverse effect attributed to cap on commercial climbing against a background of increasing independent climbers. Minor to moderate impacts from small group cross-country travel in summer.	Same as Alternative 2 but fewer commercial visitors and no cross-country commercial group impacts.	Same as Alternative 3. Negligible differences in the number of commercial visitors and trips. Least potential for impacts due to fewer user nights.
Wildlife	Impacts similar to Guided Climbing Alternative	Impacts similar to Guided Climbing Alternative 2.	Impacts similar to Guided	Negligible Impacts similar to

Variable	Guided Wilderness Alternative 1	Guided Wilderness Alternative 2	Guided Wilderness Alternative 3	Guided Wilderness Alternative 4
	1. Major impact if highest potential number of commercial visitors were added to independent use already occurring.	Negligible impact compared to independent commercial use from approximately tripling 2001commercial use.	Climbing Alternative 2. Negligible impact from moderate increase in number of people and user nights over 2001.	Alternative 3 with slightly larger increase in the number of people but smaller increase in user nights.
Special Status Species	Same as Guided Climbing Alternative 1.	Same as Guided Climbing Alternative 1.	Same as Guided Climbing Alternative 1.	Same as Guided Climbing Alternative 1.
Prehistoric/Historic Archeology	No adverse effect.	No adverse effect. See Guided Climbing Alternative 2.	Same as Alternative 2.	Same as Alternative 2.
Ethnography	No effect.	No effect.	No effect.	No effect.
Historic Structures Cultural Landscapes	No adverse effect.	No adverse effect.	No adverse effect.	No adverse effect.
Visitor Experience	General Impacts from Guided Climbing above plus: Moderate impact on increasing competition and choice by offering wide array of new commercial services. Negligible to major effect on independent overnight wilderness visitors depending on the camp or zone.	Same as Alternative 1 except: Negligible to minor beneficial effect on visitor use opportunity by increasing the range of competition and choice. Negligible beneficial effect from greatest degree of flexibility and use. Minor long-term beneficial effect on independent park visitor experiences during peak season coupled with negligible adverse effect on commercial visitor experiences from inability to use some wilderness camps on weekends. Negligible adverse effect from no summer weekend trips on Northern Loop Trail. Negligible beneficial effect from slight to moderate expansion in the number of visitors who could take advantage of guided wilderness trips.	Similar to Alternative 2 except: Negligible to minor adverse effect on visitor use opportunity/access due to only two trips per CUA. Negligible adverse effect from no summer weekend use available.	Similar to Alternative 2 except: Negligible adverse effect due to limited number of user nights. Negligible adverse effect from no summer weekend trips on Northern Loop Trail.
Wilderness	Same as Guided Climbing Alternative 1.	Same as Guided Climbing Alternative 2 plus: Potential for minor to moderate adverse effect on summer solitude if some semi-primitive trails become transition trails, particularly in the vicinity of the Westside Road.	Same as Alternative 2.	Same as Alternative 2.
Park Operations	Same as Guided Climbing Alternative 1.	Same as Guided Climbing Alternative 2.	Same as Alternative 2.	Same as Alternative 2.
Socioeconomic Environment	Highest degree of revenue.	Next highest degree of revenue.	Middle range of revenue.	Approximately the same as Alternative 3.

IMPACT COMPARISON CHART
Guided Alpine Wilderness

Variable	Guided Alpine Wilderness Alternative 1	Guided Alpine Wilderness Alternative 2	Guided Alpine Wilderness Alternative 3	Guided Alpine Wilderness Alternative 4
Air Quality	Same as Guided Wilderness Alternative 1	Same as Guided Wilderness Alternative 2.	Negligible impacts slightly increased over Alternative 2.	Same as Alternative 3 (based on number of trips).
Water Quality	Same as Guided Climbing Alternative 1	Initial negligible increase from increase in number of clients over 2001 baseline, followed by long-term decrease due to client cap over potential in Alternative1, and required use of strategies to avoid, minimize or mitigate impacts. Minor, localized Impacts from gray water disposal/length of stay on glacier.	Same as Alternative 2. Negligible differences in number of people and user nights.	Same as Alternative 2. Negligible differences in number of people and user nights.
Geological Hazards	Same as Guided Climbing Alternative 1.	Same as Guided Climbing Alternative 2.	Same as Alternative 2.	Same as Alternative 2.
Soils and Vegetation	Similar to Guided Wilderness Alternative 1, however fewer impacts overall, since most activity would take place in non-vegetated areas (on glaciers).	Negligible to minor impacts primarily associated with accessing the Alpine Winthrop and Alpine Nisqually/Paradise cross-country areas lessened by the required use of strategies to avoid, minimize or mitigate impacts.	Same as Alternative 2.	Same as Alternative 2.
Wildlife	Impacts similar to Guided Climbing Alternative 1. Greatest potential for increase (moderate impact) in number of people and user nights from additional CUAs.	Impacts similar to Guided Climbing Alternative 2. Negligible impacts from slight increase in number of people and user nights.	Same as Alternative 2 with slightly greater increase in number of people and user nights.	Same as Alternative 2.
Special Status Species	Same as Guided Climbing Alternative 1.	Same as Guided Climbing Alternative 1.	Same as Guided Climbing Alternative 1.	Same as Guided Climbing Alternative 1.
Prehistoric/Historic Archeology	No adverse effect.	No adverse effect. See Guided Climbing Alternative 2.	Same as Alternative 2.	Same as Alternative 2.
Ethnography	No effect.	No effect.	No effect.	No effect.
Historic Structures Cultural Landscapes	No adverse effect,	No adverse effect.	No adverse effect.	No adverse effect.
Visitor Experience	Similar to Guided Climbing General Impacts plus:	Negligible adverse effect from concessioners not offering non-summit mountaineering trips combined with beneficial effect from potential for increased collaboration among park commercial service providers. Negligible beneficial effect from increased competition and choice among guided alpine	Same as Alternative 2.	Same as Alternative 2.

Variable	Guided Alpine Wilderness Alternative 1	Guided Alpine Wilderness Alternative 2	Guided Alpine Wilderness Alternative 3	Guided Alpine Wilderness Alternative 4
		wilderness service providers. Negligible beneficial effect from increased opportunity for CUAs to provide a variety of skills training.		
Wilderness	Negligible to moderate effect on summer solitude associated with various trails and trail segments as expansion of the type and range of CUAs in wilderness occurred.	Negligible effect on summer solitude associated with increased use of the Alpine Winthrop and Alpine Nisqually/Paradise areas.	Same as Alternative 2.	Same as Alternative 2.
Park Operations	Same as Guided Climbing Alternative 1.	Same as Guided Climbing Alternative 2.	Same as Alternative 2.	Same as Alternative 2.
Socioeconomic Environment	Highest range of revenue.	Minor range of revenue.	Same as Alternative 2.	Same as Alternative 2.

IMPACT COMPARISON CHART
Additional Services

Variable	Additional Services Alternative 1	Additional Services Alternative 2
Air Quality	Negligible to moderate impacts from increasing the number of vehicles in the park. Negligible to minor impacts from increasing the number of CUAs. Negligible to moderate beneficial impact from more shuttle CUAs. Continued minor to major localized adverse impacts from campfires.	Initial negligible to minor increase from increase in number of CUAs/clients over 2001 baseline, followed by long-term decrease due to required use of shuttles and strategies to avoid, minimize or mitigate impacts. Negligible beneficial effect from new commercial services evaluation process by avoiding, minimizing or mitigating impacts before new commercial services are approved. Negligible particulate emissions from increased use of Westside Road. Negligible to minor beneficial effect from limitations on vehicle idling and increased shuttle use. Continued minor to major localized adverse impacts from campfires.
Water Quality	Same as Climbing Alternative 1.	Initial negligible to minor increase attributed to increase in number of CUAs/clients over 2001 baseline, followed by long-term decrease due to required use of shuttles and required use of strategies to avoid, minimize or mitigate impacts. Negligible beneficial effect from new commercial services evaluation process by avoiding, minimizing or mitigating impacts before new commercial services are approved. Negligible additional impacts associated with off-trail use in sensitive areas less than Alternative 1. Negligible to minor increase in potential for impacts associated with new or expanded CUA activities. Mountain circumnavigations and Muir Winter Guides same potential as in Alternative 2 Guided Alpine Wilderness for gray water disposal impacts.
Geological Hazards	Same as Guided Climbing Alternative 1 (above) plus: Relatively few visitors in vicinity of Westside Road, where hazards have occurred somewhat frequently.	Negligible to major potential for geological hazards to occur unaffected by Alternatives. Moderate additional number of commercial visitors exposed to existing and potential hazards. Negligible long-term beneficial impacts from required geological hazards orientation for guides and clients that would result in better informed commercial visitors. Additional minor beneficial impact from specific information conveyed during Westside Road activities.
Soils and Vegetation	Negligible to minor or moderate localized impacts from major increase in number of CUAs, particularly from activities that include hiking, since most activities would take place in or near developed areas, on hardened surfaces or on designated trails. No impacts from shuttle transportation, firewood sales or guided bicycling.	Similar to Alternative 1. Initial negligible to moderate increase in impacts (depending on the activity, where it took place, and how well it was managed) from number of CUAs/clients over 2001 baseline, followed by long-term minor beneficial impact from the required use of strategies to avoid, minimize or mitigate impacts. Negligible to minor disturbance from additional CUAs, which would be concentrated in the same areas and seasons as now. Negligible beneficial effect from new commercial services evaluation process by avoiding, minimizing or mitigating impacts before new commercial services are approved.
Wildlife	Similar to Guided Climbing Alternative 1. Greatest potential number of new CUAs and number of people that could participate in guided activities and disturb wildlife.	Initial minor to moderate increase from number of CUAs/clients over 2001 baseline, followed by long-term decrease and required use of strategies to avoid, minimize or mitigate impacts. Negligible to minor disturbance from additional CUAs, which would be concentrated in the same areas and

Variable	Additional Services Alternative 1	Additional Services Alternative 2
		seasons as now. Negligible beneficial effect from new commercial services evaluation process by avoiding, minimizing or mitigating impacts before new commercial services are approved. Minor to moderate noise and disturbance from congregation and dispersal of visitors for increased winter activities. Moderate localized disturbance and displacement of wildlife from increased use in the vicinity of Westside Road.
Special Status Species	Same as Guided Climbing Alternative 1.	Same as Guided Climbing Alternative 1. Negligible beneficial effect from new commercial services evaluation process by avoiding, minimizing or mitigating impacts before new commercial services are approved.
Prehistoric/Historic Archeology	No adverse effect.	No adverse effect. See Guided Climbing Alternative 2. Negligible beneficial effect from new commercial services evaluation process by avoiding, minimizing or mitigating impacts before new commercial services are approved.
Ethnography	No effect.	No effect.
Historic Structures Cultural Landscapes	No adverse effect.	No adverse effect. Long-term beneficial effect from continued use of the Westside Road.
Visitor Experience	Negligible to moderate impact on commercial groups trying to reserve campsites from demand that would exceed availability. Moderate to major effect from minimally controlled expansion of CUAs. Long-term beneficial effect from continued regulation of visitor use.	Minor beneficial effect from increased range of commercial services and increased competition for these services. Negligible beneficial effect and negligible adverse effect from range of new services, with some visitors taking advantage of them and some visitors avoiding them. Minor long-term beneficial effects from increased dissemination of resource protection messages in a variety of settings coupled with minor to moderate short-term, localized adverse effects from the activities themselves, mitigated by monitoring and enforcement of permit conditions. Long-term negligible beneficial effect to park resources and therefore visitor enjoyment of those resources from new commercial services evaluation process by avoiding, minimizing or mitigating impacts before new commercial services are approved. Negligible beneficial effect from Muir Winter Guides on increasing visitor access. Long-term beneficial effects on visitor access and enjoyment by increasing shuttle and other access and use of the Westside Road coupled with concurrent negligible short-term adverse effect as some visitors reacted to the change and a minor long-term adverse effect by increasing crowding in this area of the park that has remained somewhat less used due to difficulty of access in recent years. Potential for a moderate adverse effect from providing shuttle transportation to some areas of the park, where previous access was limited by the size of the parking area. Negligible long-term beneficial impact by increasing the number of towing services available within the park.
Wilderness	Same as Guided Climbing Alternative 1.	Same as Guided Climbing Alternative 2 plus: Potential minor to moderate adverse effect on summer solitude if some semi-primitive trails become transition

Variable	Additional Services Alternative 1	Additional Services Alternative 2
		trails, particularly in the vicinity of the Westside Road. Additional negligible to minor adverse effect on summer solitude from number of people participating in commercially guided activities.
Park Operations	Same as Guided Climbing Alternative 1.	Same as Guided Climbing Alternative 2 plus: Moderate long-term beneficial effect from new systematic evaluation of commercial services, in minimizing the effects of commercial services on park operations.
Socioeconomic Environment	Highest range of revenue.	Moderate range of revenue.

➢ AIR QUALITY

Air Quality Impacts of Guided Climbing Alternative 1
Ongoing use of helicopters for fall and spring high altitude human waste barrel placement and removal as well as delivery of supplies to high camps, coupled with heavy equipment and private vehicle use for this and other commercial services operations, as well as propane use for cookstoves at Camps Muir and Schurman and the snow melt water system at Camp Muir would continue to result in a negligible to minor adverse impacts on air quality.

Although the climbing concessioner for Muir and Other Routes currently uses only a small portion of the allowable limits established by the park on these routes (see Table 1: Maximum Allowable Commercial Use Limits by Alternative) under the existing or a future contract, use could rise from approximately 4,145 annually to 8,260 during summer alone if the route was used to capacity every day. Consequently concessioner use of the Muir Route has the potential to more than double, however weather and route conditions would continue to limit the ability to reach this maximum route capacity. Future limits would only result from revisions to the Wilderness Management Plan or a new Commercial Services Plan or Carrying Capacity Plan. As a result there would be increasing impacts to air quality from increased numbers of guided climbers traveling to and through the park. These impacts, however, would continue to come from a small minority of park visitors. Climbers currently constitute less than two percent of all park visitors. Against the background of ongoing visitor use, the contribution of impacts to air quality from climbing would continue to be negligible to minor.

On the Emmons and Kautz routes future commercial use would be allotted through CUAs. While there are four IBPs now on the Emmons Route and none on the Kautz Route, there would be no future limit on the number of CUAs that could be issued for these routes under this Alternative. As a result, commercial climbing use on the Emmons Route could increase from a maximum potential ofl 192 commercial visitors per summer (and year) to a percentage of the total route capacity (5,400 people per summer). Similarly, commercial climbing on the Kautz Route could increase from approximately 41 people per year to a percentage of the total route capacity (5,040 people per summer). Because, however, limitations on future CUA holders would be similar to those on IBP holders now, impacts to air quality would remain negligible since CUA clients would be shuttled to and within the park.

Air Quality Impacts of Guided Climbing Alternative 2
While overall visitor use would likely continue to rise slightly under this and other Alternatives as predicted in the GMP, overnight climbing would be capped slightly above 2001 levels, resulting in a long- term negligible decrease in air pollution from vehicle emissions compared to Alternative 1. There would be a slight decrease over 2001 that would come (as shown in Table 1) from a similar slight decrease in guided climbers on the Muir Route (where one concessioner would lead guided climbs), coupled with a moderate increase in guided climbers on the Emmons, Kautz and Other routes (where four concessioners would lead guided climbs). As noted, this increase would be much less than the increase predicted to occur over time in Alternative 1.

Because all commercial climbing clients would be required to be shuttled under this and other action Alternatives (2- 4), any increased impacts from vehicle emissions would remain negligible. Over time, there could be a long- term negligible decrease in air quality impacts if the increase in guided climbers resulted primarily from redistributed, rather than new visitors.

In this and other action Alternatives (2- 4), the number of helicopter flights to resupply high camps would decrease since supplies for concessioners would no longer be flown to Camp Muir and would not begin at Camp Schurman or Camp Hazard. The number of flights for human waste barrel placement and removal would continue to be similar to Alternative 1, but would decrease over time as human waste management practices improved.

Air Quality Impacts of Guided Climbing Alternative 3
Because most actions associated with Alternative 3 would be the same as Alternative 2, impacts would also be the same. The only exceptions would be with respect to different limits on commercial visitors on Other routes (100 fewer) and the addition of Single- Trip Guides (90 more). Compared to Alternative 2, Alternative 3 would redistribute the same use caps associated with the Muir, Emmons and Kautz, and Other routes divided among an equal number of concessioners. As a result, compared to Alternatives 1 and 2, Alternative 3 would result in further reduced vehicular air emissions associated with climbing.

Air Quality Impacts of Guided Climbing Alternative 4
Under this Alternative the reduction in the number of visitors compared to the Alternative 1 would be great, resulting in similar decreases in air quality emissions related to climbing. Compared to Alternative 2, there would be a marked decrease on the Muir Route, as well as a collective decrease in use of the Emmons, Kautz and Other routes. The number of Single- Trip Guides, however would remain the same as Alternative 3. Because there would be fewer climbers overall compared to other Alternatives, however, Alternative 4 would have the smallest degree of air quality emissions related to climbing.

Conclusion: Climbing Alternatives 2- 4 would have fewer air quality impacts than Climbing Alternative 1. Alternative 4 would have the fewest impacts because fewer people would participate in guided climbing and, as in Alternatives 2 and 3, there would no longer be helicopter flights to carry concessioner supplies to high camps. Air quality impacts would continue to be negligible to minor since concessioner clients and employees would be required to be shuttled. There would be no impairment of air quality or air quality related values from any of the alternatives.

Air Quality Impacts of Guided Wilderness Alternative 1
In this Alternative, aside from adherence to current overnight camping limits established by the Wilderness Management Plan and without other limits established by a Commercial Services Plan or Carrying Capacity Plan, the current moratorium on new commercial uses would be lifted. Therefore, the only limitations on the number of CUAs issued by the park for guided wilderness use would be as a result of existing Wilderness Management Plan area limits. As a result guided wilderness use would be expected to increase over time from 94 people in 2001 to a number based on the ability to issue permits to qualified applicants and their ability to reserve wilderness campsites or access them first- come first- served in competition with the public. With 37 wilderness camps each containing from 2- 4 individual sites and 1- 2 group sites, and maximum limits on individual of 5 people and group sites of 12 people, the potential combinations of trips and maximum number of trips would be great (see Table 11: Total Potential Wilderness Camp Summer Visitor Use). Because there are no current limits on the number of sites that could be reserved by commercially guided visitors in this Alternative (although the historic practice has been to limit commercial use to approximately 30 percent of total use), this activity would increase and would result in concurrent impacts to air quality associated with travel to and within the park. Unlike climbing, shuttles for commercially guided wilderness visitors are currently not required and it is likely that travel could be by private vehicle. As a result existing negligible impacts to air quality from the transport of 94 people could increase to minor or even moderate, depending on the actual number of CUAs and people. Operational limitations on these permits, including specifying the number of vehicles that could be parked at a trailhead, adding a requirement for shuttles, or stipulating increasing reliance on cleaner fuel vehicles could reduce air quality emissions.

Air Quality Impacts of Guided Wilderness Alternative 2
Compared to the increased potential in Alternative 1 for a high number of CUAs and commercial visitors taking advantage of guided wilderness use in Alternative 1, there would be 3 CUAs in this Alternative that would result in a maximum number of 396 people (on a maximum of 33 trips) per year. Although this would be a decrease from the maximum potential in Alternative 1, it would actually constitute an increase over 2001 use (with a maximum of 94 people on 9 trips). Therefore initially, there would be a slight potential for increased air quality emissions related to

travel to and within the park. Over the long- term, this initial increase would be small in comparison to Alternative 1 and to other air quality impacts associated with independent visitor use. Because commercial visitors in this and other action alternatives (2- 4) would be required to be shuttled, actual impacts from more than quadrupling the number of people (over 2001 numbers) that could take advantage of commercially guided wilderness trips would be negligible.

Air Quality Impacts of Guided Wilderness Alternative 3
There would be fewer air quality impacts associated with Alternative 3 due to the reduced number of visitors that could take advantage of commercially guided wilderness opportunities in this Alternative (120) and trips (10) compared to either Alternative 2 or Alternative 1. These visitors, however, would be transported in shuttles by 5, rather than 3 or a greatly increased number of CUAs. Therefore, the slight increase associated with more CUAs transporting fewer visitors would be balanced by fewer visitors overall being transported. Impacts would continue to be negligible.

Air Quality Impacts of Guided Wilderness Alternative 4
There would be approximately the same air quality impacts associated with Alternative 4 as with Alternative 3 since the number of visitors that could take advantage of commercially guided wilderness opportunities in this Alternative (144) and trips (12) would be substantially similar to Alternative 3 (120 and 10). Instead, of 5 CUAs, however there would be 2, resulting in slightly fewer (and continued negligible) impacts associated with visitor transport on shuttles.

Conclusion: Guided Wilderness Alternatives 2- 4 would have fewer air quality impacts than Guided Wilderness Alternative 1, which could have minor or even moderate impacts. Alternative 3 would have the fewest impacts because fewer people would participate. Air quality impacts associated with these alternatives would continue to be negligible compared to ongoing impacts to air quality associated with independent visitor use since concessioner clients and employees would be required to be shuttled. There would be no impairment of air quality or air quality related values from any of the alternatives.

Air Quality Impacts of Guided Alpine Wilderness Alternative 1
As described above in the Impacts of Wilderness Alternative 1, there is a potential for a major increase in the number of CUAs to be issued in this Alternative. Once again, limitations would be only as a result of current overnight camping limits from the Wilderness Management Plan. Therefore alpine wilderness use would be expected to increase over time as more CUAs were issued to conduct this activity. Camping in the cross- country alpine zones and high camps associated with this use would again be in competition with the public, either through a reservation or first- come, first- served basis. As a result, impacts related to vehicle air emissions would also increase over time, with no requirement (currently) to shuttle clients or to limit the size or type of vehicles. As in the above Alternative 1 for guided wilderness, operational limitations, if implemented, could reduce these anticipated impacts. Impacts from commercial alpine guided wilderness use would range from negligible to minor.

Air Quality Impacts of Guided Alpine Wilderness Alternative 2
Compared to the increased potential in Alternative 1 for a high number of CUAs and commercial visitors taking advantage of guided wilderness use in Alternative 1, there would be 5 4- night CUAs in this Alternative that would result in a maximum number of 240 people (on a maximum of 24 trips with the maximum group size) per year. Although this would be a decrease from the maximum potential in Alternative 1, it would actually constitute an increase from 2001 use (180 people on 12 trips). Therefore initially, there would be a slight potential for increased air quality emissions related to travel to and within the park. Over the long- term, this initial increase would be small in comparison to Alternative 1. Because commercial visitors in this and other action alternatives (2- 4) would be required to be shuttled, actual impacts from more than doubling the number of people (over 2001 numbers) that could take advantage of commercially guided wilderness trips would be negligible.

Air Quality Impacts of Guided Alpine Wilderness Alternative 3

There would be slightly greater (though continued negligible) air quality impacts associated with transporting commercially guided alpine visitors in Alternative 3 due to 48 more people being able to take advantage of these commercially opportunities. These visitors would be transported in more shuttles – 8, rather than 5 (Alternative 2) or a major increase in the number of CUAs (Alternative 1).

Air Quality Impacts of Guided Alpine Wilderness Alternative 4

There would be approximately the same air quality impacts associated with Alternative 4 as with Alternative 2 since the number of visitors that could take advantage of commercially guided wilderness opportunities in this Alternative (240) and trips (20) would be the same as Alternative 2 . Instead, of 5 CUAs, however there would be 10, possibly resulting in more impacts associated with visitor transport on shuttles if the groups were smaller.

Conclusion: As in the Guided Climbing and Guided Wilderness Alternatives above, because commercial visitors and employees would be required to be shuttled under Alternatives 2- 4, impacts associated with these alternatives would remain negligible, while impacts from Alternative 1 could become minor, depending on the number of CUAs and clients. There would be no impairment of air quality or air quality related values.

Air Quality Impacts of Additional Services Alternative 1

As shown in Table 1, the increase in potential use over 2001 figures for Alternative 1 would in some cases result in an unknown future number. This could result in the approval of numerous CUAs with the potential to impact air quality, including not only those shown in the table, but also other appropriate activities similar to those listed in Appendix B in the accompanying Commercial Services Plan document. More CUAs would likely be issued for winter and summer day use activities, commercial educational courses, commercial camping, commercial bicycling, and commercial road tours, as well as for other activities. The suitability of the activity would continue to be evaluated on a case- by- case basis and would include the evaluation of administrative permitting requirements.

Ongoing diesel and other emissions related to road- based bus and van tours would continue to have a minor, localized adverse impact on air quality. When contrasted with stationary and mobile vehicle emissions outside the park, the contribution from the park's small size and limited developed areas would be insignificant. Increasing reliance on alternative fueled vehicles for shuttles and other in- park uses (such as for heating and equipment) would continue to result in a cumulative minor beneficial effect.

Particulates, nitrogen oxides, carbon monoxide and other associated pollutants from automotive emissions, would increase as more vehicles entered and traveled through the park. As a result, minor increases in visitation would continue to result in a minor adverse effect on local air quality. As with other emissions, the contribution of automobile emissions in the park compared to regional air emissions would be negligible.

Collectively the inability to limit most CUAs would result in negligible to minor or moderate increases in air pollutants associated with travel to and within the park. There would also be increases in travel associated with these operations over time. Operational limitations on these permits could specify some of the same conditions now required of park concessioners, including shuttling of clients and employees, limitations on vehicle idling, increasing reliance on cleaner burning fuels, etc.

Shuttles: The continued requirement for shuttling commercial climbing clients and guides and shuttling non- resident GSI employees on the west side of the park would result in a minor beneficial impact on air quality due to the reduction in air pollutants emitted by individual vehicles that would otherwise enter the park. There would also be a major increase in the number of shuttle CUAs issued under this Alternative that collectively would contribute to a negligible to moderate beneficial effect on air quality, as more visitors took advantage of both reservations only and scheduled shuttle services.

Firewood: Continued selling of firewood for individual campfires at Cougar Rock, White River and Ohanapecosh campgrounds would result in minor to major localized adverse impacts, depending on the time of year, on air quality, including a prevalence of haze and the odor of wood smoke around developed campgrounds and in other nearby developed areas, especially in summer. This impact however would not be noticeable over most of the park. It would, however, continue to contribute negligibly to regional air emissions.

Air Quality Impacts of Additional Services Alternative 2

In Alternative 2, a new evaluation process to determine the suitability of proposed new or expanded commercial services would consider not just the suitability of the businesses' administrative or permit qualifications, but also the effects of the activity on a wide variety of park resources, including air quality. As a result, approved activities would be less likely to affect park air quality because approval would include appropriate strategies to avoid, minimize or mitigate adverse impacts to air quality.

Air quality impacts under Alternatives 2- 4 would be reduced over Alternative 1, because commercial operations would be required to shuttle their clients and guides and other staff in the park. This would result in a long- term negligible to minor decrease in air quality impacts, although associated with other increases in new commercial visitor use opportunities, there would be a minor to moderate number of new visitors attracted to these increased opportunities and the air quality impacts associated with these visitors would be new and negligible to minor. But because use would dramatically decrease over the potential for maximum use that could occur in Alternative 1, the addition of some new activities, modification of existing activities and expansion of others would result in fewer air quality impacts than that Alternative. There are specific differences in air quality impacts related that would result from increasing shuttle transportation and road tours parkwide and instituting shuttles on the Westside Road as discussed below.

Shuttles/Road Tours: More visitors using commercial services and more independent visitors would be likely to use shuttles under this alternative since this alternative provides more than a five- fold increase in the number of shuttle service providers. These shuttle services would include both reservation and scheduled services and could together (over time) result in a negligible to minor reduction in the number of private vehicles entering the park since they would not be mandatory and their use would depend on convenience to or incentives offered to park visitors. There would be a negligible to minor cumulative beneficial effect compared to Alternative 1. Limiting idling of the small number of tour buses and other road- based tours would also have a negligible beneficial effect in reducing vehicle emissions.

Westside Road Shuttles: More consistent shuttles, rather than infrequent administrative use of the gravel Westside Road would also result in more particulate emissions from dust rising along this gravel road. The use of shuttles would have a minor to moderate localized effect on other visitors using the road at the same time, however overall the increase in particulate emissions would be negligible compared to particulate emissions from logging activities in the vicinity of the park. Particulate emissions along gravel roads would also decrease the photosynthesizing capability of roadside vegetation during dry periods, which combined with other automotive emissions would likely contribute to an overall negligible to minor decline in roadside vegetative health, and which could affect species composition over time. To reduce the potential for dust, lower speed limits would continue to be used on gravel roads. Possible shuttle use of the gravel Carbon River or Mowich Lake roads would result in the same impacts. With such use, however, there would likely be a concurrent decrease in the number of private vehicles over the same area, resulting in a long- term negligible beneficial, rather than adverse, effect.

New CUAs: Adherence to limitations proposed on the number of CUAs that would be available in this Alternative (including towing, road tours, guided day hiking, guided winter activities, Westside Road bike tours, guided bicycling, photography and art courses, step- on guides, commercial camping and winter guides to Camp Muir) would likely result in a moderate increase in the number of visitors taking advantage of commercial services. This increase would occur against the background of increasing park visitors but would also likely include visitors that

would come specifically to take advantage of these new opportunities. As a result, there would be a negligible to minor increase in air pollutant emissions associated with travel to and within the park.

Conclusion: For Additional Services Alternative 1, there would continue to be negligible to moderate localized long- term air quality impacts coupled with negligible to moderate short- term localized air quality impacts and negligible to moderate beneficial impacts on air quality. Against the background of impacts associated with increasingly urbanized southwest Washington and with the greatest degree of impacts occurring only in summer, these impacts would not be significant. There would be slightly fewer long- term air quality impacts in Alternative 2 compared to Alternative 1, primarily because of limits placed on existing or new commercial services operations and because of required management strategies that would avoid, minimize or mitigate air quality impacts. These alternatives would not result in impairment of park air quality resources or values.

Conclusion/Cumulative Impacts: There would continue to be minor to moderate adverse impacts on air quality associated with more emissions from a slight increase in visitation over time. Contributing to these impacts would be continued use of campfires in park campgrounds, vehicle travel associated with travel to and through the park for an increasing number of CUAs for a variety of activities, against a background of air quality impacts related to a growing population in the surrounding communities and from nearby forestry practices and distant industrial uses. The continuation of employee and concessioner client and employee shuttles would result in a negligible to minor beneficial effect. Increasing the number of CUAs for shuttle transportation to and within the park would also result in a minor beneficial increase.

The actions associated with the implementation of these alternatives would not result in impairment of park air quality or air quality related values.

➢ SOILS

(see *Water Quality* and *Soils and Vegetation* below)

➢ WATER QUALITY

DISCUSSION

Visitor use, including by commercial groups, particularly in wilderness can result in adverse impacts to water quality resulting from the contamination of water used in cooking or cleaning, soil compaction and erosion related to footpath establishment and the need for disposal of human waste.

Trampling: Initially, trampling may bend or break plant parts. Depending on the community type, as trampling occurs, human (and animal) use may escalate, resulting in the formation of a social or way trail. Social or way trails, in turn, may become pathways for water runoff during heavy rain or spring snowmelt. As water moves faster and faster over the site, it picks up soil particles and begins to channel through and erode the affected area. Inappropriately located or constructed trails, may cause sedimentation of nearby water resources, including streams, springs and lakes. Trampling of lake and stream shorelines during recreational activities, such as fishing or hiking along shorelines, may also result in increased erosion with increasing loss of vegetation. Large groups need more space and can increase the potential for trampling and the need for off- trail passing by smaller groups and individuals.

Human Waste: Without removal, at high elevations on popular climbing routes, human waste can accumulate in the snowpack, due to slow decomposition from low temperatures, desiccation, and high exposure to solar radiation. In alpine areas, where cold temperatures and no soil predominate, the number and activity of microorganisms is reduced (Gauthier 1999). Human

waste left in an alpine environment can therefore be encountered during melt- out the next spring. It can also be transported via wind to contaminate nearby "clean" snow. As a source of water contamination, human waste can increase health risks related to melting snow for drinking water. The sight of human waste affects the climbing experience and mountain aesthetics (Gauthier 1999). In one study 57 percent of climbers felt that human waste detracted from their experience (Swearingen and Johnson 1983).

The presence of coliform bacteria is a useful indicator for water quality, including indicating the presence of other pathogens. A study done on the Muir Route in 1982 found snow samples at Crater Rim, Ingraham Flats and Camp Muir to have moderate levels of viable coliform bacteria. This study also showed that fecal matter bacterial organisms could survive freeze/thaw conditions at high altitudes (**Macartney 1982**). In addition, preliminary sampling at two sites below Camp Muir in 1994 showed elevated levels of nitrate- nitrite, ammonia nitrogen and Kjeldahl nitrogen (NPS 1986 cited in NPS 2002).

Gray Water: Improper disposal of gray water resulting from washing or cooking may also impact localized water quality. In frontcountry developed campgrounds, gray water sinks are provided, but may not be used. In wilderness (including in winter and summer), proper disposal of gray water is an important minimum impact technique to protect water quality and to prevent wildlife habituation.

Strategies to Avoid, Minimize or Mitigate Impacts to Water Quality

The following strategies to limit the effects of operational and recreational use on water quality have been developed and implemented to varying degrees in the park. Many of the strategies have multiple objectives and have an effect on limiting impacts to other park resources as well. They include:

- requiring permits for overnight use (these encourage minimum impact techniques, and ensure allowed use is consistent with established overnight wilderness limits);
- constructing trails in appropriate terrain, using established techniques;
- rehabilitating social trails;
- requiring designated trailside camps a minimum of 200 feet from water sources;
- locating toilets (pit, composting or solar) at trailside camps.
- establishing the blue bag system for winter and high elevation human waste disposal;
- minimizing group sizes in wilderness (overnight party sizes of 12 or fewer and 5 or fewer);
- limiting the use of sensitive areas by large groups

In addition, park wilderness visitors are encouraged to:

- use impact minimization techniques, such as *Leave No Trace*;
- use biodegradable soap and dispose of gray water more than 200 feet from water sources;
- use maintained or established way trails to limit establishment of social trails and consequent soil erosion;
- use rest stops on snow, or durable or established areas;
- camp and recreate on snow, rather than in fragile subalpine or alpine plant communities;
- use blue bags during high elevation travel; and to
- walk on snow, rather than sensitive emerging vegetation, whenever possible.

Water Quality Impacts of Guided Climbing, Guided Wilderness, Guided Alpine Wilderness, and Additional Services Alternative 1

In this alternative, many commercially guided visitors are also encouraged to use the above strategies through contract agreements or operating plans. Some commercial groups, however, are required to use them. Concession and IBP guided climbers are limited to a maximum group size (although recent concession use is higher than the Wilderness Management Plan overnight use limit). And, blue bags must be used by all climbers in alpine cross- country areas. In addition, concession guides are trained in *Leave No Trace* techniques and are expected to pass this information on to their clients.

By proactively managing visitor use impacts on water quality (such as by designating camps and trails and implementing other visitor use strategies to minimize impacts to water quality), the park minimizes effects on water quality related to visitor use. By further encouraging commercially guided groups to use some of the other strategies listed above, as well as requiring the use of others results in negligible to minor, occasionally localized impacts to water quality when these strategies are followed and minor to moderate localized impacts when and where they are not employed. Monitoring of commercial groups increases compliance with permit conditions. These adverse impacts to water quality may include increased nutrient loads, sedimentation, and the introduction of other pollutants.

Under these Alternatives, commercial use of front country areas and wilderness trail use would increase in the absence of revisions to the existing Wilderness Management Plan or the establishment of a Carrying Capacity Plan. Independent use of these same areas would likely also increase concurrently. While the number of commercial park visitors compared to independent park visitors cannot be determined, it is likely that there would be a combined increase over time, similar to the trend seen in annual visitation.

At the same time, while commercial groups would be required to use some of the above mitigation strategies to avoid, minimize or mitigate impacts to water quality, most strategies would remain just suggested. Ongoing human waste collection and removal would continue and would also increase over time as visitation increased. As a result, there would continue to be minor localized impacts to water quality, caused primarily by non- compliant behavior, such as off- trail travel in sensitive or closed areas or improper disposal of gray water or human waste. Most wilderness visitors and many non- wilderness visitors, however, would continue to comply with park regulations and to employ minimum impact techniques.

Conclusion/Cumulative Impacts: There would continue to be negligible to moderate impacts to water quality associated with these Alternatives from ongoing park operations and visitor use. Visitor use impacts would primarily be related to non- compliant visitor behavior resulting in sedimentation or unnatural inputs of nutrients to park waters. No impairment of park water resources or associated values would occur.

Water Quality Impacts of Guided Climbing Alternative 2

Under this and other action alternatives (2- 4), requiring rather than encouraging use of the following management strategies to avoid, minimize or mitigate water quality impacts would have the potential to result in reduced water quality impacts:

- requiring concessioners to teach *Leave No Trace* or other minimum impact techniques to their clients;
- requiring all commercially guided groups to use rest stops on snow, or in durable or established areas;
- requiring large groups in summer to use designated trailside camps in low elevation wilderness;
- requiring large and small groups using high elevation wilderness or those on winter trips to use the blue bag system for human waste disposal.

Use of these strategies would result in fewer impacts to water quality from the improper disposal of human waste, gray water and from the use of potential pollutants in this Alternative. The actual effectiveness of these strategies would depend on required guide training, guide return consistency, guide familiarity with the route and other factors.

Under this and other action alternatives (2- 4) another toilet would be constructed at Camp Schurman to accommodate current existing and the increased regular use of the Emmons Route. This would result in a long- term minor beneficial effect on managing human waste at this high camp and on water resources, since the toilet would be a self- contained and would not release waste into the surrounding environment.

There would be a short- term increase in the overall number of commercial visitors participating in various guided activities, until the use limits under this Alternative were met, than compared to Alternative 1, there would be fewer people participating in guided commercial activities over time. As shown in Table 1, this increase would be exceeded by the increase from Alternative 1. While there would continue to be a potential for initial increased impacts to water quality by non-compliant individuals and groups, overall impacts would be less than Alternative 1 and would continue to be negligible throughout most of the alpine zone, but could be minor to moderate following such non- compliant behavior in localized areas.

Water Quality Impacts of Guided Climbing Alternative 3
Because the same strategies to avoid or minimize impacts to water quality would be used and because the number of climbers that could potentially be served in Alternative 3 would be only 80 people more than Alternative 2, potential localized impacts to water quality would be nearly the same as Alternative 2 and like that Alternative, substantially lower than Alternative 1.

Water Quality Impacts of Guided Climbing Alternative 4
As in Climbing Alternatives 2 and 3, the same strategies to avoid or minimize adverse impacts to water quality would be used in this Alternative. In this Alternative, however, there would be 1,300 fewer climbers overall, as a result this Alternative would have the lowest potential for adverse impacts to water quality but the range of potential impacts would be the same as described above.

Conclusion/Cumulative Impacts: There would continue to be negligible to minor impacts to water quality associated with these Alternatives from commercially guided climbers. Visitor use impacts would primarily be related to non- compliant visitor behavior resulting in sedimentation or unnatural inputs of nutrients to park waters. No impairment of park water resources or associated values would occur.

Water Quality Impacts of Guided Wilderness Alternatives 2
As noted above the strategies listed above under *Impacts of Climbing Alternative 2* also apply to the wilderness alternatives. Use of these strategies would result in fewer potential impacts to water quality from the improper disposal of human waste, gray water and from the use of potential pollutants in this Alternative. The actual effectiveness of these strategies would depend on required guide training, guide return consistency, guide familiarity with the route and other factors.

In this and other action alternatives (2- 4) large and small groups could travel cross- country in winter on snow. In this alternative (unlike 3 and 4), small groups could also travel and camp in cross- country areas in summer. As a result, there would be a greater potential for water quality impacts to occur related to visitor use impacts in wilderness in these cross- country areas where no toilets, trails and camping areas are designated. These impacts, compared to other alternatives, could range from minor to moderate.

Although the visitor use limits associated with this Alternative (396 people on 33 trips) would be a decrease from the maximum potential in Alternative 1, they would actually constitute an increase over 2001 use (180 people on 12 trips). Therefore initially, there would be a slight potential for increased water quality impacts related to an increased number of visitors traveling and camping in park wilderness. Over the long- term, this initial increase would be small in comparison to Alternative 1. In addition, because the number of people that could participate in commercially guided wilderness travel and camping would be small in comparison to independent visitors taking part in the same activities and both would be small compared to annual overall wilderness use (see Table 12: Wilderness Overnight Use 2001), the potential for impacts would be negligible overall (primarily as a result of increased restrictions on and monitoring of commercial use) and negligible to moderate in localized areas primarily due to non- compliant behavior.

Water Quality Impacts of Guided Wilderness Alternative 3
There would be fewer water quality impacts associated with this Alternative than with Wilderness Alternative 2, although the strategies to avoid or minimize those impacts would be the same. Like Alternative 2, increased monitoring and regulation of commercial services would have a tendency

to reduce impacts. Unlike Alternative 2, there would be no cross- country travel or camping for small groups, therefore because all groups would be required to stay in designated wilderness campsites, where toilets, designated sites and water sources occur, there would be less potential for impacts associated with improper disposal of human waste, gray water and less potential for sedimentation associated with off- trail use in sensitive areas. Alternative 3 also would have the smallest number of visitors (and number of trips) for commercially guided wilderness trips (120 people on 10 trips). There would also be fewer impacts because fewer trips would be taken in summer, resulting in even less potential for off- trail erosion impacts in sensitive areas. Under this Alternative, however, there would be the greatest number of CUAs issued, resulting in a higher potential for guides taking fewer trips. There could be greater potential in this Alternative than in 2 or 4 for guides to be less familiar with park regulations and to be less compliant with these since the risk of losing the CUA due to non- compliant behavior would be less. The actual potential would be based, however on many other factors, such as the technical qualifications of the guides based on training and experience and the experience and management of the CUA business. As in Alternative 2, however, the potential for this small number of commercial visitors to cause more than negligible impacts would be slight. Compared to existing annual wilderness overnight use as shown in Table 10 (variously 14, 10, 20 and 29 percent of overnight visitors use park wilderness), the number of commercial visitors constitutes a very small percentage of use.

Water Quality Impacts of Guided Wilderness Alternative 4

As in Alternative 3, there would be fewer impacts to water quality from the implementation of this Alternative than either Alternative 1 or 2. Impacts associated with this Alternative would be essentially the same as Wilderness Alternative 3, since the number of people and the number of trips would be similar – 144 people and 12 trips vs. 120 people and 10 trips in Alternative 3. The major difference is that in this Alternative, the fewest number of CUAs would be issued. Impacts would remain negligible similar to Wilderness Alternative 3 and would only range to localized moderate effects with non- compliant behavior. As noted, against a background of much greater and less regulated independent use, these would be negligible overall.

Conclusion/Cumulative Impacts: There would continue to be negligible to minor impacts to water quality associated with these Alternatives from commercially guided wilderness visitors. Visitor use impacts would primarily be related to non- compliant visitor behavior resulting in sedimentation or unnatural inputs of nutrients to park waters. Impacts associated with commercial visitors would be fewer than those associated with a much greater number of independent visitors and against a background of ongoing water quality impacts from other park operations such as wastewater treatment that impact water quality. No impairment of park water resources or associated values would occur.

Water Quality Impacts of Guided Alpine Wilderness Alternatives 2, 3 and 4

As noted above the strategies listed above under *Impacts of Climbing Alternative 2* also apply to the alpine wilderness alternatives. Use of these strategies would result in fewer potential impacts to water quality from the improper disposal of human waste, gray water and from the use of potential pollutants in this Alternative. The actual effectiveness of these strategies would depend on required guide training, guide return consistency, guide familiarity with the route and other factors.

Because activities would be conducted on snow or glaciers and the blue bag system for human waste disposal would be employed, there would be few impacts overall to water quality related to alpine wilderness use in Alternatives 2, 3 and 4. Because, however, each trip would last up to four days and gray water disposal would continue to be a problem, localized minor effects are anticipated. These effects would be greatest in Alpine Wilderness Alternative 1, followed by 3 and then similar impacts associated with the equal numbers of visitors likely to participate in these activities in Alternatives 2 and 4 (once again, similar to the Wilderness Alternatives, the only differences might be with respect to the number of returning CUAs (10 in Alternative 4 and 5 in Alternative 2). In either case, impacts would tend to be localized and minor, but negligible overall compared to a background of greater independent use and impacts from other park operations.

Water Quality Impacts of Additional Services Alternatives 2

Like the climbing, wilderness and alpine wilderness alternatives above, the same strategies listed in *Impacts of Climbing Alternative 2* above would be employed. As a result, impacts associated with this Alternative would tend to be avoided, minimized or mitigated. In these Alternatives, in addition to the actions listed above under climbing, some new or expanded CUAs activities would also be offered, including new opportunities for shuttles, towing, road tours, day use and winter use guided activities, and Westside Road Bicycle Tours. Some of these new and expanded opportunities would likely result in a variety of potential impacts to water quality as described below. No other impacts would be anticipated as a result of firewood sales, shuttles on paved roads, bicycling on paved or unpaved roads, or camping in developed campgrounds.

All of the activities which allow some type of trail access, including commercially guided road tours, day use hiking, winter activities, and photography and art courses would have the potential for negligible impacts associated with off trail use in sensitive areas, for example exploring the shoreline of park lakes and streams. Other impacts could result from the improper disposal of human waste. These potential impacts would be negligible against a background of off- trail wilderness exploration and use by independent visitors and because commercial groups would be required to use designated trails and would be monitored for compliance with this and other requirements.

Mountain Circumnavigations and Muir Winter Guides would have the potential to cause the same gray water disposal impacts as described above for Alpine Guided Wilderness Alternatives 2, 3 and 4. Like the winter guided activities, these trips would also be required to use the blue bag human waste disposal system.

Westside Road Shuttle: Although a Westside Road shuttle would be introduced, thereby increasing the number of trips on the Westside Road (which under Alternative 1 is for administrative use only), keeping speed limits low would reduce the potential for dust to enter the adjacent Tahoma Creek and other waters. As a result, under Additional Services Alternative 2, there would continue to be minimal localized impacts to water quality that would continue to be less than those related to inputs from natural systems (particularly wildlife and natural water erosion) and non- commercial visitor use within the park. In addition there could be more trampling of area water shorelines related to increased numbers of visitors being able to access areas that currently require longer access hikes. (On the Westside Road, longer access routes now serve to limit the number of people in these areas.)

Conclusion: There would continue to be negligible to moderate impacts to water quality in this Alternative associated with ongoing park operations and visitor use. Initially, impacts would increase as a result of new and expanded commercial visitor use opportunities, however, there would be fewer long term impacts due to new requirements to avoid or minimize impacts before they occur. No impairment of park water resources of associated values would occur.

➢ GEOLOGICAL HAZARDS

Discussion

Glacial outburst floods occurred almost regularly during the late 1980s and early 1990s on Tahoma Creek, which parallels the Westside Road. When staff and visitors were stranded following one such outburst, the road was closed to all but administrative use pending environmental analysis of alternatives. This resulted in the 1992 Westside Road Environmental Assessment (National Park Service 1992) which analyzed several alternatives for the future of the road. Among the alternatives included rerouting the road, realigning some portions of the road, permanently closing the road and temporarily closing the road pending further analysis of the frequency of outburst flooding. The selected alternative became temporary closure of the road with reevaluation every three years. Since that time, the park GMP has been completed and the selected alternative in that document has superceded the above Environmental Assessment. The GMP identified a Westside Road shuttle as part of its selected alternative.

Geological Hazards Impacts of Guided Climbing, Wilderness, Alpine Wilderness and Additional Services Alternatives 1

These alternatives would result in a moderate number of additional commercial visitors in the park being subject to existing and potential park geological hazards. Park visitors are warned, in critical areas, and on park publications of the potential for geological hazards and assume the risk of continuing to recreate in these areas. This also applies to park commercial visitors. Geological hazards educational information and parkwide escape and evacuation routes are continuing to be identified and implemented.

Westside Road: In the absence of implementing the preferred alternative from the GMP, continued reevaluation of the frequency of glacial outburst flooding on the Westside Road would occur, as called for by the Westside Road Environmental Assessment every few years. Ongoing administrative traffic would continue to periodically use the Westside Road, primarily to rehabilitate wilderness trails and structures and to provide access for research and resource management activities such as inventory and monitoring. The road would continue to be maintained as part of the Mount Rainier National Historic Landmark District. As a result of the ongoing administrative use, few people would travel in vehicles on the Westside Road (though many would continue to access the area via foot or bicycle or via skis or snowshoes in winter).

Conclusion: There would continue to be the potential for a range of negligible to major impacts depending on the location, magnitude and intensity of the event. These impacts could occur regardless of the actions proposed in this alternative. There would be no impairment associated with the risk from geological hazards.

Geological Hazards Impacts of Guided Climbing, Wilderness, Alpine Wilderness Alternatives 2-4 and Additional Services Alternative 2

Alternatives 2- 4 in these categories would also increase the number of people potentially present in areas of geological hazards. All alternatives would result in the same potential maximum use based on allocation of CUAs as limited or unlimited (see Alternatives section in accompanying plan document). These alternatives would also require orientation to the NPS and park mission training for guides and among the topics included would be geological hazards. As a result, commercial visitors would likely be better informed about such hazards than independent visitors, and possibly better prepared for the consequences.

Westside Road Bicycle Tours/Westside Road Shuttle: Additional Services Alternative 2 proposes a new visitor shuttle and bicycling tours on the Westside Road. As a result, there would be a greater potential that more people would be on the Westside Road during a glacial outburst flood. As part of the shuttle ride and as part of the bicycle tours more orientation to the potential risks of these events and being on the Westside Road would occur. Ongoing assessment of glacial outburst flooding potential would also continue and would ensure that warnings and closures if needed would be enacted if warning of unstable conditions was possible. Heightened sensitivity would continue to occur following heavy fall rains and very warm dry periods in late summer.

Conclusion: These alternatives could result in more, but better informed visitors being in hazardous areas. The risk from geologic hazards would continue to be negligible to major over most of the park, but would be minor to major on the Westside Road. In the vicinity of the Westside Road, there would be more, better informed visitors who could be subject to a geohazard, such as a glacial outburst flood. Although unexpected geological hazards could occur anywhere in the park, some areas, such as the Westside Road, continue to be considered more susceptible to frequent hazards. Instituting a shuttle system on this road was identified in the park GMP as a way to facilitate use of the road while being able to inform visitors of the risks and potential escape or evacuation routes available. There would be no impairment of geological hazards, associated resources or values.

➢ SOILS AND VEGETATION

Discussion

The most commonly observed human impact on vegetation is trampling. Some plants cannot survive even a few footsteps. The Restoration Handbook (National Park Service 1990:4- 6) identifies the effects of trampling on plants:

- mechanical damage to vegetation (broken, matted, bruised, or crushed vegetation, reduced vigor)
- changes in vegetative composition (loss of species or increase in another species over time)
- soil compaction (may decrease space between soil particles, decrease plant germination, increase runoff, decrease water infiltration)
- removal of surface litter and organic matter (may change nutrient availability, increase runoff, decrease infiltration, and increase soil erosion)
- changes in soil chemistry (combined effect of loss of litter and increased compaction)
- changes in soil temperature and moisture conditions (with loss of shading from plant parts and increase in bare areas including increase in frost or needle ice).
- soil loss (affected by plant cover, slope length and gradient, rainfall, snowmelt and soil type, including structure and organic content)

The severity of the impact depends on the frequency, intensity (number of people or times) and duration of trampling, as well as the stage of growth (seedling, sapling, mature, dying back) and the type of growth form (grass, cushion, mat, forb, shrub, tree), and the type of plant community.

Illegal campsite construction is another commonly observed human impact in alpine areas. Campsite construction may result in the same impacts as described above, but also may include the following:

- displacement of stones to create a tent platform (exposing plant roots to drying, uprooting or erosion, increasing potential for needle ice formation)
- creation of stone windbreaks
- leveling site conditions for a tent pad.

Physical changes to sensitive alpine areas, where harsh growing conditions already predominate, may result in long- lasting impacts. Particularly in fellfields and other alpine areas, moving stones from their natural configuration can disrupt or destroy fragile microclimates created in the shelter of the stones, adversely affecting plants. Clearing the cobbles for tent platforms or windbreaks also destroys the natural rock arrangement of these areas. Even with restoration, these impacts can leave scars that last for decades. Heather communities can be affected by the creation of braided footpaths as hikers and climbers try to avoid snow patches along popular routes (Steelquist 1986).

Other human impacts that affect vegetation and other resources include the creation of social trails, litter, feces, damaging or defacing natural features (vandalism or graffiti), collecting wood for campsite feature construction, illegal campfires and resting or passing slower parties off trail. Inadvertent impacts may result when fast parties try to overtake slow parties on narrow trails, when visitors lose ill- defined trails, when soggy areas cause visitors to take a detour, when portions of an established trail melt- out later than other portions and cause visitors to detour and when visitors want to reach snow- patches off trail during spring melt.

Even so, plant communities differ in their tolerance of human impacts. In Mount Rainier National Park, lowland forested areas tend to be more tolerant of human impacts and take less time to recover, even without intervention, than subalpine or alpine areas (Wilderness Management Plan 1989, Restoration Handbook 1990). Resistance is the ability of a plant community to withstand impacts and resilience is its ability to recover naturally following impacts. Whereas lowland forested areas have both, natural plant re- establishment, depending on the type of impact, in subalpine areas may take many years, while recovery in the alpine zone (depending on the community affected) may take decades or centuries (Edwards 1980:19 cited

Willard and Marr 1971). Generally, the harsher the growing conditions, the longer the period for recovery. In addition, species with underground growing tips (such as sedges) are often more resistant to trampling than species with above ground growing tips (such as heather or huckleberry) because they can continue to grow when trampled (Restoration Handbook 1990:4). As recently as 1980, no re- establishment of vegetation in denuded campsites (noted in the 1970s) in the fellfields was noted (Edwards 1980: 20). The same study also found annual growth on heathers to be in the range of a few millimeters. A study in Rocky Mountain National Park (cited in Edwards 1977:2) found that plant cover 50 years after removal was only half that of similar communities elsewhere. Another study in Glacier National Park found that recovery in an alpine environment occurred within 20 to 30 years (Hartley 2000). Another study in the Rocky Mountains cited in the Restoration Handbook (Willard and Marr 1970) demonstrated that a fellfield lightly trampled for one season recovered to near normal in two seasons, whereas one which had been trampled for 25 years would take an estimated 500- 1,000 years to recover.

Soils and Vegetation Impacts of Guided Climbing Alternative 1

Continued Visitor Use In Popular Alpine And Subalpine Areas: Numerous studies have confirmed that despite the implementation of measures to avoid, minimize or mitigate human impacts to soils and vegetation that impacts continue to occur, not only on the Muir Route, but in other areas as well. Visitors in alpine and subalpine areas continue to be attracted to snow free areas. Although the message to stay on trails especially in popular non- wilderness areas ("Don't be a meadow stomper!") and to use minimum impact techniques in wilderness has been widely spread, there are currently no designated trails above Pebble Creek on the Muir Route. Instead braided systems of undesignated way trails have developed. The same is true above Glacier Basin and in other subalpine and alpine zones. As a result there continues to be degradation of resource conditions over these and other heavily used areas.

Climbing Alternative 1 (despite management practices that encourage otherwise) would continue to have minor to moderate human impacts on vegetation and soils. Limited staff is available to monitor the activities of both commercial and non- commercial overnight visitors and the ongoing increasing use of the Muir and other climbing routes for day hiking. The Muir Snowfield would continue to be used both for commercial and non- commercial overnight groups as a secondary camping area for those who reserve it in advance or those who cannot make the climb to Camp Muir before tiring out. These visitors would continue to be required to camp or rest on snow. Undesignated routes above the end of maintained trails (such as above Pebble Creek and Glacier Basin) would continue to lead to visitor confusion causing the subsequent creation of braided social trails.

Without management changes stemming from an increased restoration program, increased funding and/or a new Wilderness Management Plan or Carrying Capacity Plan, impacts to vegetation, including impacts occurring in sensitive subalpine and alpine areas, would not only continue to persist, but would likely increase and result in more destruction of vegetation and soil erosion. Depending on the plant community type these impacts would take from a few months to hundreds of years to restore. While some direct restoration of high priority subalpine meadows (such as at Paradise and Sunrise) occurs, high elevation restoration is not only costly but also time consuming and would be unlikely to result in restoration of all impacted areas. Still, the park would continue to minimally monitor human impacts, particularly in subalpine and alpine areas and would, pending influxes of restoration project funding, restore heavily impacted areas to the degree possible.

Mitigating Human Impacts: Under this and other alternatives, the park would continue to use the following strategies (most as described in Johnson, Vande Kamp and Swearingen (1994)) to avoid, mitigate or minimize the adverse effects of human use on vegetation, soils and other park resources.

TABLE 13: STRATEGIES TO AVOID, MINIMIZE OR MITIGATE RESOURCE IMPACTS

STRATEGY	AVOID	MINIMIZE	MITIGATE
Informal personal contacts	x	x	
Regulatory signs	x	x	
Barriers	x	x	
Interpretive talks	x	x	
Exhibits	x	x	
Interpretive signs	x	x	
Brochures	x	x	
Audiovisual presentations	x	x	
Newsletters/Newspapers	x	x	
Direct enforcement	x		
Area closures	x		
Improving the quality of access	x	x	
Construction of new facilities	x	x	
Rerouting access trails or roads	x		x
Improvements to landscape or facility design	x		x
Indirect use quotas	x	x	
Direct use quotas	x	x	
Restoration			x
(Park added) Monitoring of commercial services (including determining consequences of non-compliance)	x		x

Over time, these strategies, used alone or in combination, have been effective at discouraging use of sensitive or closed areas.

Expansion Of Commercial Use: While the current amount of commercial use offered by Alternative 1 is (in most cases) less than that offered by the other action alternatives, because there would be no way to limit future increases in use (primarily for CUAs – see Air Quality discussion), Alternative 1 offers the greatest potential for growth in commercial use.

Conclusion: Consequently, Alternative 1 would continue to result in negligible to major impacts to park soils and vegetation, particularly in subalpine and alpine areas, which are more sensitive to intermittent or one- time disturbance. The contribution of commercial services to these impacts would be negligible to moderate, depending on the area affected (impacts are more likely to be more severe in the less resilient (therefore sensitive) subalpine and especially alpine plant communities, than in the lowland forested area). Over time, however, the contribution of commercial services to these impacts would increase proportionally according to growth in the respective businesses.

Alpine

- Because the greatest potential for human use to cause lasting damage is in alpine areas,
- because the most diverse alpine areas are also the most popular climbing routes,
- because each alpine area affected by human use is a unique high elevation environment due to slope and aspect,
- because alpine areas may take between tens and hundreds of years to recover and may not recover without intervention, and
- because it is unlikely that the park can obtain sufficient funding and staffing to prevent damage to these areas under this alternative,

Alternative 1 has the potential to result in impairment or loss of some ecological communities in park alpine areas. This would result from a combination of non- commercial and commercial use and current limitations on restoration, monitoring and enforcement.

Subalpine

In subalpine areas compared to alpine areas, Alternative 1 would be less likely to result in impairment of vegetation and soils:

- because there are designated trails that would continue to be used by most visitors and commercially guided parties
- because the park continues to maintain an active restoration program, that includes, inventory, monitoring, signing, closure and if needed, revegetation or restoration of high use subalpine areas.

As a result, Alternative 1 could continue to result in minor to major impacts to subalpine vegetation, especially if, although the intent to complete restoration is a park goal, funding is not available.

Forested

Finally, in forested areas, Alternative 1 would continue to result in negligible to moderate impacts to forest soils and vegetation. The impacts in this vegetation community would be less likely to be severe due to the resiliency of forests to recover following minor disturbance and because most visitors (including commercial users) would tend to stay on designated trails due to the closed appearance of the forested landscape.

Conclusion: With potential for a major increase in the number of CUAs and an associated unknown number of clients, Guided Climbing Alternative 1 has the potential to result in impairment or loss of some ecological communities in park alpine areas, particularly if use were to increase on some of the less well- traveled climbing routes. This would result from a combination of non- commercial and commercial use and current limitations on restoration, monitoring and enforcement. In subalpine areas there could be minor to major impacts, particularly if subalpine restoration funding decreases. Impacts would range from negligible to moderate in the more resilient forests.

Soils and Vegetation Impacts of Guided Climbing Alternatives 2-4

Alternatives 2- 4 include the following strategies to avoid, minimize or mitigate impacts to soils and vegetation. These alternatives:

- require guides and guide to client ratios for most commercial services;
- set up an optional training program for guides to become more familiar with the park;
- define an interim maximum allowable use for commercial services in Mount Rainier National Park that will be in effect until revisions to this plan, the Wilderness Management Plan or until carrying capacity studies have been completed;
- eliminate commercial overnight use of the Muir Snowfield and reduce overall camping limits on the snowfield from 36 people per night to 24 people per night to reduce the potential for impacts to surrounding sensitive fellfields;
- incorporate analysis of potential resource impacts into the evaluation of new commercial services to minimize their effect on soils and vegetation and other resources;
- require large commercial groups to stay on designated trails or standard routes in summer when the potential for the impacts to soils and vegetation is greatest;
- require concessioners and CUA holders to use and teach minimum impact techniques, such as Leave No Trace (LNT);
- require commercial groups traveling in winter or above developed areas in summer to use blue bags;
- have specified maximum allowable commercial group sizes for various activities;
- require commercial use of the Kautz Route and Fuhrer's Finger via Paradise rather than Van Trump Park;
- incorporate the designation of standard climbing route access paths through typically snow-free areas above currently designated trails;
- require commercial guides to participate in orientation training to better understand the National Park Service and park's mission and goals;
- increase monitoring of commercial services by climbing, resource and concessions staff by increasing the revenue generated from commercial services (a portion of which may be used for administration and monitoring); and
- increase designation and marking of campsites along climbing routes.

New Strategies To Avoid, Minimize Or Mitigate Vegetation Impacts: As a result of the above strategies, even though there would initially be increased visitor use under these alternatives, over that which occurred in Alternative 1 in 2001, annual limits would cap overall use. Requiring commercial visitors to employ the above strategies would result in fewer long- term impacts from commercial visitors on soils and vegetation, and therefore would have a long- term moderate to major beneficial effect on vegetation. Independent overnight and day use visitors would continue to increase slightly over time and would not have the same requirements as commercial visitors. Therefore, although commercially guided visitors would be employing the above strategies, independent visitors using the same areas would not be subject to the same guidelines.

Ratio Of Commercially Guided To Non-Guided Independent Visitors: There would be a general increase in commercial groups in Alternatives 2- 4 and a gradual increase in these groups over time in Alternative 1, with overall higher maximum allowable use. This would result in a change in the ratio of independent to commercially guided visitors over time. Since the number of independent visitors is expected to continue to rise slightly over time, following annual park visitation trends (See Table 6) and the number of commercial visitors would be capped at various levels, depending on the visitor use activity under these alternatives there would be a higher long-term ratio of independent to commercial use.

Over time, this increasing ratio of guided commercial to non- guided independent groups would diminish the long- term effectiveness of the above strategies in reducing soils and vegetation impacts related to placing limits on commercial use. As a result, there would be a short- term beneficial impact on soils and vegetation coupled with a long- term slowly increasing minor to major adverse effect on soils and vegetation associated with changing the ratio of guided commercial to non- guided independent visitors (since overnight use limits would remain the same except on the Muir Snowfield). Only future changes in management of visitors in subalpine and alpine areas, as an update to the Wilderness Management Plan or management of day use visitors (such as the Carrying Capacity Plan), would limit this effect and ensure that sensitive alpine and subalpine resources were not lost or impaired as is possible in Alternative 1.

Reduced Overnight Camping On Muir Snowfield/Loss Of Muir Snowfield For Commercial Use: Alternatives 2- 4 would remove 12 commercial overnight camping spaces from the Muir Snowfield and would not replace use of those spaces with independent visitors. This would effectively reduce the overnight use limits on the Muir Snowfield from 36 people per night to 24 people per night. Decreasing the capacity of the Muir Snowfield would have a minor to moderate beneficial effect by eliminating some commercial (and independent by not replacing) camping near sensitive fellfields. Removal of the commercial use, however, may also result in diminishing the presence of concession employees on the snowfield, which may have enhanced protection of the surrounding sensitive snow free areas. This loss of presence on the snowfield could result in a negligible to moderate adverse effect by minimizing the number of people who might be communicating better understanding of park rules concerning not camping or resting in the sensitive snow free areas. It could also result in more illegal camping on these snow free areas not being noticed.

Soils and Vegetation Differing Impacts of Climbing Alternative 2

Except for the long- term effects of Alternative 1, Alternative 2 with its slight decrease (based on 2001) in use of the Muir Route and corresponding increases in the use of the Emmons, Kautz and Other Routes would likely result in the third highest potential for soils and vegetation impacts (based on the number of guided climbers and the number of user nights). Compared to Alternative 1, Alternative 2 would result in fewer long- term impacts to soils and vegetation and new strategies to avoid, minimize or mitigate resource impacts as the other alternatives (See Table 13 above).

Soils and Vegetation Differing Impacts of Guided Climbing Alternative 3

The potential for impacts from Alternative 3 to soils and vegetation would be the same as Alternative 2 with respect to the primary climbing routes, but Alternative 3 would have a somewhat lower limit on Other Routes. The Single Trip Guides introduced by this alternative

and the next would add to the total number of people and user nights. Compared to Alternative 1, there would be fewer impacts to vegetation and soils because the total maximum allowable commercial use is markedly lower. While, use numbers are higher, there would be some reduction in impacts related to when commercial use would be avoided in some areas due to the introduction of commercial free areas (rather than just times – weekdays vs. weekends in Alternative 2). These commercial free areas would be Liberty Ridge, Sunset Amphitheatre, Sunset Ridge (including Puyallup Glacier), Tahoma Glacier, and South Mowich Glacier. Access to Ptarmigan Ridge and Mowich Face would only be via Mowich Lake. As in other action alternatives, there would be an initial rise in commercial visitor use over Alternative 1. Afterwards, Alternative 3 would have a long- term minor increase in visitor use that would be capped lower than the similar long- term increases possible in Alternative 1, albeit higher than Alternatives 2 or 4.

Soils and Vegetation Differing Impacts of Guided Climbing Alternative 4
This Alternative offers a substantial overall reduction in commercial visitor use compared to the current array of use now occurring (Alternative 1) on the Muir, Kautz and Other Routes. At the same time it increases the number of potential commercially guided visitors on the Emmons Route over Alternatives 1- 3. Collectively, Alternative 4 would result in substantially lower overall commercial climbing visitor use compared to 2001 use in Alternative 1, and long- term projected allowable use in Alternatives 2 and 3. As in Alternative 3, these impacts would also be lower because in this Alternative, the following areas would remain commercial free: Tahoma Glacier, Sunset Amphitheater, and Liberty Ridge. Commercial groups, however, could access Sunset Ridge, including the Puyallup Glacier below 9,000 feet and South Mowich Glacier. As a result, Alternative 4 would have the least potential for impacts to soils and vegetation.

Conclusion: Alternatives 2- 4 would have fewer potential commercial visitor use impacts on soils and vegetation compared to Alternative 1. Even so, these impacts could range from negligible to major. The contribution of commercial use to these impacts would be small (see *Assumptions* at the beginning of this section). However, independent use could increase if future management changes were not implemented via revisions to the Wilderness Management Plan or via a Carrying Capacity Plan, therefore Alternatives 2- 4 would continue to have the potential to result in impairment of vegetation and soils, particularly in alpine zones if maximum wilderness use capacities were achieved. Because achievement of these use capacities is highly dependent on weather and route conditions, however, it is unlikely that these capacities would ever be achieved. Because, for example, the Kautz Route is usually unavailable during the early or late season due to unfavorable route conditions and because revision of the Wilderness Management Plan and a Carrying Capacity Plan is mandated by the park General Management Plan (NPS 2001) and is planned during the term of this plan, no impairment would occur. Under Alternatives 2- 4, the potential for major impacts would be further reduced by implementation of the management strategies to avoid, minimize or mitigate impacts. These would include more enforcement and monitoring of commercial use permit conditions, reducing Muir Snowfield overnight camping use by 12 people, designating more trails and campsites in snow free alpine and subalpine areas, etc. These strategies would also affect both independent and commercial visitors, further reducing the potential for impacts to occur in sensitive areas. As a result, Alternatives 2- 4 would not result in impairment of park vegetation and soil resources nor the values associated with them.

Soils and Vegetation Impacts of Guided Wilderness Alternative 1
As described above in *Impacts of Climbing Alternative 1*, there would continue to be visitor use impacts in alpine, subalpine and forested areas, from overall visitor use and from commercial visitor use. The intensity of these impacts would continue to vary by plant community and the resilience of the plant community to tolerating human impacts, particularly different levels of trampling. Visitors in alpine and subalpine areas would continue to be attracted to snow free areas and use of these areas during melt- out would continue to cause some of the greatest impacts. The greatest impacts would continue to occur in popular areas with undesignated trails or campsites. Undesignated routes above the end of maintained trails would also continue to lead to visitor confusion causing the subsequent creation of braided social trails. Degradation of resource conditions would continue to occur in these and other heavily used areas, especially in

alpine and subalpine areas. Impacts attributable to commercial visitors, however, would remain negligible to moderate, depending on the vegetation type. This alternative would allow the highest use of park wilderness by commercially guided visitors, use that could reach an unknown number of user nights (compared to 681 user nights in 2001) without the implementation of new wilderness management plan use limits through revision to the Wilderness Management Plan or a Carrying Capacity Plan.

Under this and other alternatives, the park would continue to use the strategies listed above under *Impacts of Climbing Alternative 1* to avoid, mitigate or minimize the adverse effects of human use on vegetation, soils and other park resources.

While the 2001 commercial use that occurred under Alternative 1 is less than that offered by the other action alternatives, because there would be no way to limit future increases in use, Alternative 1 offers the greatest potential for growth in commercial use. As CUAs increased under this alternative, there would be more staff available to monitor resource conditions and to implement effective mitigation strategies, however this alternative would not provide adequate resources to monitor an ever increasing number of CUAs. Currently limited staff is available to monitor the activities of both commercial and non- commercial overnight visitors.

Because most commercially guided wilderness use would continue to occur in summer and would continue to include the ability to travel and camp in cross- country areas, there would continue to be localized minor to moderate vegetation impacts in sensitive areas, primarily as a result of this off- trail wilderness use (and the varying effects related to trampling). These impacts would be concentrated in forested and subalpine areas where plant communities have a greater degree of resilience, rather than in alpine areas, where plants are generally more sensitive to even minimal changes. Overall, the impacts related to additional wilderness use by increasing numbers of commercially guided park visitors would range from negligible to minor in forested areas and minor to moderate in subalpine areas.

Soils and Vegetation Impacts of Guided Wilderness Alternatives 2-4

The same strategies listed in *Impacts of Climbing Alternatives 2- 4* above would be employed in these wilderness alternatives to avoid, minimize or mitigate impacts on vegetation and soil resources from commercial use. As a result, even though there would initially be increased visitor use under these alternatives, over that which occurred in Alternative 1 in 2001, annual limits would cap overall use. In addition, there would continue to be a much higher number of independent visitors compared to commercial visitors. Requiring commercial visitors to employ the above strategies would result in fewer long- term impacts from commercial visitors on soils and vegetation, and therefore would have a long- term moderate to major beneficial effect on vegetation. Independent overnight and day use visitors would continue to increase slightly over time and would not have the same requirements as commercial visitors. Therefore, although commercially guided visitors would be employing the above strategies, independent visitors using the same areas would not be subject to the same guidelines.

Conclusion: Because of the small number of visitors that would be able to take advantage of guided wilderness trips under these alternatives - 396 (2,520 user nights) in Alternative 2, 120 (1,140 user nights) in Alternative 3 and 144 (840 user nights) in Alternative 4 – the ratio of independent visitors to commercially guided wilderness visitors would remain high. For comparison, in 2001, there were 23,260 user nights in designated wilderness camps (excluding climbing high camps) (see Table 12: Wilderness Overnight Use 2001). Consequently, commercially guided visitors would remain few in number (stabilizing when these limits were met) while independent visitors could potentially increase. Therefore, impacts associated with commercially guided visitors would be negligible to minor, depending on the area used and how frequently such use occurred. Next to Alternative 1, these minimal impacts would be greatest in Alternative 2, moderate in Alternative 3, and lowest in Alternative 4 and would be the same as those described above under *Impacts of Climbing Alternatives 2- 4*.

Soils and Vegetation Impacts of Guided Alpine Wilderness Alternative 1
As described above in *Impacts of Climbing Alternative 1* and *Impacts of Wilderness Alternative 1*, there would continue to be visitor use impacts in alpine, subalpine and forested areas, from overall visitor use and from commercial visitor use. The intensity of these impacts would continue to vary by plant community and the resilience of the plant community to tolerating human impacts, particularly different levels of trampling. Visitors in alpine and subalpine areas would continue to be attracted to snow free areas and use of these areas during melt- out would continue to cause the greatest impacts. The greatest impacts would continue to occur in popular areas with undesignated trails or campsites. Undesignated routes above the end of maintained trails would continue to lead to visitor confusion causing the subsequent creation of braided social trails. Degradation of resource conditions would continue to occur in these and other heavily used areas, especially in alpine and subalpine areas. Impacts attributable to commercial visitors, however, would remain negligible to moderate, depending on the vegetation type. This alternative would allow the highest use of park alpine wilderness by commercially guided visitors, use that could reach an unknown number of user nights (compared to 720 user nights in 2001) without the implementation of new wilderness management plan use limits through revision to the Wilderness Management Plan or a Carrying Capacity Plan.

Under this and other alternatives, the park would continue to use the strategies listed above under *Impacts of Climbing Alternative 1* to avoid, mitigate or minimize the adverse effects of human use on vegetation, soils and other park resources.

As CUAs increased under this alternative, there would be more staff available to monitor resource conditions and to implement effective mitigation strategies, however as with other no action alternatives, this alternative would not provide adequate resources to monitor an ever increasing number of CUAs. Currently limited staff is available to monitor the activities of both commercial and non- commercial overnight visitors.

Because most alpine wilderness use would continue to occur in areas with no vegetation where ice and snow predominate, vegetation impacts would be negligible to minor and primarily related to accessing alpine wilderness areas.

Soils and Vegetation Impacts of Guided Alpine Wilderness Alternatives 2-4
The same strategies listed in Impacts of Climbing Alternatives 2- 4 above would be employed in these alpine wilderness alternatives to avoid, minimize or mitigate impacts on vegetation and soil resources from commercial use. The effect would also be the same as described there and above in *Impacts of Wilderness Alternatives 2- 4*, that is, there would be fewer long- term impacts from commercial visitors on soils and vegetation and a subsequent long- term beneficial effect on these resources. In addition, regardless of party size, commercially guided alpine wilderness groups would be required to camp and recreate on snow to avoid any additional impacts to vegetation.

Because of the small number of visitors that would be able to take advantage of alpine guided wilderness trips under these alternatives - 240 (960 user nights) in Alternative 2, 288 (1,152 user nights) in Alternative 3 and 240 (960 user nights) in Alternative 4 – the ratio of independent visitors to commercially guided wilderness visitors would remain high. For comparison, in 2001, there were 23,260 user nights in designated wilderness camps (excluding climbing high camps) (see Table 12: Wilderness Overnight Use 2001). Consequently, commercially guided visitors would remain few in number (stabilizing when these limits were met) while independent visitors could potentially increase. Therefore, impacts associated with commercially guided visitors would be negligible to minor, depending on the area used and how frequently such use occurred. Under this alternative, unlike Alternative 1, alpine wilderness trips would be limited to the Alpine Winthrop and Alpine Nisqually/Paradise cross- country areas, thereby reducing the potential for vegetation impacts during access even further. These minimal impacts would be greatest in Alternative 2 and lowest in Alternative 4 and would be the same as those described above under *Impacts of Climbing Alternatives 2- 4*.

Conclusion: Because of the small number of visitors that would be able to take advantage of guided alpine wilderness trips under these alternatives – 240 (960 user nights) in Alternatives 2 and 4, 288 (1,152 user nights) in Alternative 3 – the ratio of independent visitors to commercially guided wilderness visitors would remain high. For comparison, in 2001, there were 9,754 user nights in alpine areas (excluding designated alpine high camps) (see Table 12: Wilderness Overnight Use 2001). Consequently, commercially guided visitors would remain few in number (stabilizing when these limits were met) while independent visitors could potentially increase. Soil and vegetation impacts associated with commercially guided visitors would remain negligible to minor, primarily as a result of most use being on ice and snow. Next to Alternative 1, these minimal impacts would be greatest in Alternative 3, and least in Alternatives 2 and 4. There would be no impairment to park soils or vegetation or their values from the implementation of Wilderness Alternatives 1- 4.

Soils and Vegetation Impacts of Additional Services Alternative 1
With a potential major increase in the number of CUA holders for day use activities, drive- in group camping, guided bicycling, road tours, shuttles, towing, mountain circumnavigations and Camp Muir winter guides, this alternative could result in negligible to minor impacts to vegetation and soils. These impacts would primarily be associated with activities that involved a hiking component, including day use activities, Camp Muir winter guides and mountain circumnavigations. Other activities, such as commercial group camping would include the use of well- used developed areas where impacts have already occurred by the designation of the group campsites, etc. Most hiking would be expected to occur on designated trails or routes, however, where off- trail use occurred, there would be damage to vegetation and soils. While towing would not generally result in vegetation impacts, where towed vehicles left the roadway and landed on surrounding hillslopes, minor to moderate localized vegetation impacts could result. These and other impacts associated with Additional Services would continue to be negligible to minor or moderate and localized in extent. There would continue to be no impacts associated with shuttle transportation, firewood sales or guided bicycling.

Case- by- case evaluation of new commercial services would continue to result in periodic, but non- systematic evaluation of proposals with respect to their impacts on vegetation (see air quality impacts above).

Soils and Vegetation Impacts of Additional Services Alternative 2
Additional Services Alternative 2 would also add new and/or enhanced opportunities for commercial services in the following guided visitor activities: day hiking, bicycling, Westside Road bicycle tours and shuttles, road tours, winter recreational activities, commercial group camping, Camp Muir winter guides, and mountain circumnavigations. It would also continue firewood sales at two campgrounds and allow for enhanced towing services in the park. Individually and collectively these activities have the potential to affect park soils and vegetation by causing an array of impacts to forest, subalpine and alpine vegetation and soils. Use of the above strategies, however, to avoid, mitigate or minimize impacts to soils and vegetation would limit the extent of these expected impacts by commercial visitors to negligible to moderate depending on the activity, where it took place and how well it was monitored and managed. Expected impacts would be negligible to moderate since most of these activities would continue to take place in existing developed areas and roads and on designated trails and routes where such impacts would be avoided by the presence of hardened surfaces, designated trails, and other features, such as designated campsites.

The new commercial services evaluation process would result in a systematic evaluation of proposed new commercial services with respect to vegetation as well as other resources. Proposals that affected these resources would be modified to avoid, minimize or mitigate impacts. Therefore, new commercial services would likely result in more negligible to minor impacts on vegetation and would continue to adhere to the strategies described above to minimize impacts.

Conclusion: Additional Services Alternative 1 could result in negligible to moderate, primarily localized impacts to vegetation and soils due to the potentially major increase in the number of CUAs that could be issued. Most use, however, would be expected to occur on designated trails or routes or in developed areas, where additional impacts would be minimal. Although

Additional Services Alternative 2 adds new activities that may also occur in Alternative 1, it includes a variety of impact avoidance, minimization and mitigation strategies that would be used to effectively lessen the potential negligible to moderate localized impacts that could occur. Most use would continue to be in areas where impacts have already occurred, such as on designated trails and in developed areas. The new Commercial Services Evaluation Process would continue to ensure that impacts from proposed new CUAs remained minimal. There would be no impairment to park soils or vegetation or their values.

➢ WILDLIFE

Discussion

The primary effects on wildlife associated with the Alternatives described in this Environmental Assessment would consist of:

- noise, disturbance and other incidental habitat modification (primarily vegetation trampling) associated with visitor use of commercial services,
- noise and disturbance associated with administrative actions for the management of commercial services,
- habituation of wildlife as ongoing or more frequent commercial use occurred in some areas, and
- wildlife/vehicle collisions.

Wildlife Impacts of Guided Climbing, Wilderness, Guided Wilderness and Additional Services Alternative 1

Ongoing Park Operations: The number of people and the density of trails and developed areas in the park continue to result in documented wildlife feeding, habituation, and vehicle collisions, and most likely result in at least some displacement of wildlife (particularly in developed areas) and effects on reproductive success (particularly in areas where visitor use is relatively consistent or where its consistency occurs during a critical time).

Under these Alternatives, persistent noise and disturbance associated with visitor and administrative use, including commercially guided use, of developed areas would also continue to result in ongoing decreases in the presence of many wildlife species in the vicinity of developed areas and along some popular trails and routes especially during the day. At night, there may be an increase in species presence if the human activity has diminished or been removed (unless the activity is sufficient to cause more permanent displacement). Even during daylight, however, there would continue to be a number of species, such as deer and some birds that would become habituated to this disturbance and over time would not avoid it. Where consistent human use continues to occur, species that are more tolerant of human activity may persist. Throughout much of the park, however, the rise and fall of human activity would continue to be somewhat predictable and regular with detectable seasonal and weekend/weekday patterns. Only in major developed areas, in campgrounds and picnic areas, and along roads and high and moderate use trails would there be more consistent human presence in the summer. In winter, at wilderness campsites and along most trails and less easily accessible areas, human use would continue to be more intermittent in nature. Finally, in most of the park, where designated trails do not exist there would be only occasional cross- country use (in both winter and summer). Ongoing park operations, including visitor use would continue to result in a negligible to moderate localized adverse effect primarily associated with developed areas (3 percent of the park). In much of the rest of the park even in summer, this localized effect would be even smaller and more dispersed and associated with a small number of high and moderate use trails and routes.

The contribution of commercial use to ongoing visitor use in the park has not been studied, however each of the alternatives below is evaluated against the relative increase or decrease in human use that would occur pending its selection in this plan. As mentioned earlier, current guided commercial use (based on 2001 reported figures) makes up a very small percentage (approximately 2/10 of 1 percent) of overall visitor use.

Expansion of CUAs: As noted above, this alternative would have the greatest potential for an unknown increase in guided commercial visitor use. Without a Commercial Services Plan or another document that identified use limits for existing and potential commercial services, most CUAs would be granted on an essentially unlimited basis. As a result, commercial visitor use would increase until limited by some other factor, such as limitations in the commercial viability of the business or the wilderness overnight use limits established by the park's Wilderness Management Plan (1992).

This increase in commercial visitor use would primarily be limited to developed areas and designated trails within wilderness and would be subject to existing park regulations and policies that support resource protection goals which prevent the feeding and harassment of wildlife. Ongoing park education and enforcement to limit food scraps and litter and other impacts to wildlife would continue. As a result, visitor effects on wildlife would be negligible to minor and would not affect populations or the prevalence of species, but would continue to have negligible to moderate effects on individuals of some species.

In these alternatives, there would continue to be fewer designated trails and campsites than in Alternatives 2, 3 and 4. As a result, there would continue to be greater potential impacts to wildlife habitat in these areas (particularly related to concessioner guided climbing) from uncertainty related to which of the several braided way trails should be used above existing designated trails. This would continue to have a minor to moderate localized impact on wildlife habitat in alpine areas.

Administrative Helicopter Use: As described above under Water Quality, this Alternative would also include continued administrative use of helicopters to remove human waste barrels throughout the park and to resupply high camps as well as to repair and maintain wilderness trails and other structures. Fall and spring helicopter flights occur over a span of a few days and have been established as the minimum tool to mitigate the effects of the collection of human waste in high elevation areas (snowfields and glaciers) and to prevent its inappropriate disposal.

- Because these flights occur during two short periods each year,
- because they incorporate analysis of potential wildlife impacts (including threatened and endangered species – see below), and
- because they travel over the shortest possible flight path,

the effects of these flights on wildlife would continue to be minor and outweighed by their benefit in not contributing an unnatural source of contaminants/nutrients to the Mount Rainier ecosystem.

Conclusion: There would continue to be negligible to moderate localized effects on wildlife from continued visitor use and administrative operations for commercial services. No impairment of park wildlife or wildlife related values would result.

Wildlife General Impacts of Guided Climbing, Wilderness, Guided Wilderness and Additional Services Alternatives 2-4

Increased Winter Commercial Visitor Use Opportunities: Although most commercial visitor use would occur like most general visitor use, in summer – permit conditions would encourage a certain portion of use to be spread into winter. This would likely result in a slightly increased percentage of commercial use in winter, especially when coupled with new or expanded winter guided commercial use opportunities. Because of variable weather conditions the increased winter use would be expected to be minor. As a result, most commercial use would continue to occur during the summer, comparatively diminishing the effects of localized increases to negligible to minor in winter.

New or Expanded Commercial Visitor Use Opportunities: Most commercial use would also occur within major developed areas and on designated trails and standard climbing approach routes. The frequency of use would vary by Alternative, depending on the number of allowable trips and the maximum allowable visitor use (see below). Mitigation strategies common to all action alternatives, such as limiting large groups to winter cross- country travel and camping on

snow and requiring that concessioner guided climbers use standard approach routes would help to minimize trampling in sensitive and other areas, therefore also limiting effects on wildlife habitat.

Other resource protection measures to mitigate human impacts on wildlife would continue to be used under all alternatives, including area closures when sensitive species are found breeding, and ongoing environmental impact analysis and demographic studies on a few key species.

In addition, the strategies listed above (*Soils and Vegetation Impacts of Climbing Alternatives 2- 4*) would also be used to avoid, minimize or mitigate effects to wildlife habitat. These would slightly increase the number of designated campsites and trail sections (in sensitive alpine areas), limit use of sensitive areas by commercial services, increase the ratio of guides to clients in commercially guided parties, require smaller group sizes and minimize trampling of vegetation by requiring guided groups to rest on snow or durable areas, among other requirements. Finally, monitoring of commercial groups would increase and would result in better management of these groups to minimize impacts.

Under these Alternatives, there would be a small degree of ground disturbance in sensitive alpine and subalpine areas to further designate more segments of climbing routes to prevent the use of a series of braided social trails that converge where the designated trails end – particularly above Pebble Creek and Glacier Basin. There would also be more designation of overnight campsites as appropriate to reduce impacts where inappropriate camping areas have developed and suitable durable sites exist nearby. While these actions would have minor impacts on wildlife habitat already degraded by unregulated visitor use, they would result in a long- term minor beneficial effects by reducing the number of social trails.

As described above in other resource impact analyses, the primary difference among the concessioner guided climbing, wilderness, and alpine wilderness alternatives is the number of concessioners or CUAs that would be authorized, as well as the maximum number of people that could be accommodated and how many trips would be taken. The range of impacts on wildlife are described above (*Impacts of Climbing, Wilderness, Alpine Wilderness, and Additional Services Alternative 1*) and the differences (which primarily relate to the number of people, user nights, and establishment of commercial free times or areas) associated with the alternatives are described below.

Wildlife Impacts of Guided Climbing Alternatives 2, 3 and 4

While there would be no additional wildlife habitat removal under these alternatives, there would be more commercial use of the Emmons and Kautz routes and approximately the same (Alternatives 2 and 3) or less (Alternative 4) use of the Muir Route, while increased commercial use would also occur on Other Routes in all alternatives. These increases in use would be small in comparison to ongoing independent use of existing developed areas, roads, trails and climbing routes in most areas.

Climbing Alternative 2: This alternative would have the third highest number of guided climbers (5,360) and the third highest number of user nights (8,080). Impacts on wildlife, therefore, would potentially be lower than Alternatives 1 and 3 and higher than Alternative 4.

Climbing Alternative 3: Next to Alternative 1, this alternative would have the greatest potential for impacts on wildlife since it has the second highest total number of guided climbers (5,350) and user nights (8,320). With the competition offered by three equal concessioners, these use limits would be more likely to be achieved in this Alternative than in either Alternative 2 or 4 (Price Waterhouse Coopers 2003). Commercial free areas would result in a negligible beneficial effect on wildlife, since independent climbers would continue to use these same areas. There would be approximately 100 fewer guided climbers on Other Routes, however this Alternative would add Other Route usage by Single- Trip Guides of 90 people per year (540 user nights) on potentially longer trips, resulting in a slight increase in the number of people and user nights over Alternative 2.

Climbing Alternative 4: This alternative would have both the fewest number of people (4,090) and the lowest number of user nights (6,540) therefore it would have the fewest number of impacts on wildlife. As in Alternative 3, commercial free areas would offer a negligible beneficial effect on wildlife. This alternative would have negligibly higher effects on the Emmons Routes, with six more trips.

Conclusion: Although there would be an increase in use over 2001, Alternatives 2- 4 would have fewer potential commercial visitor use impacts on wildlife compared to Alternative 1. These localized impacts could range from negligible to moderate but would not affect wildlife populations or their presence parkwide. Many of the management strategies that would occur as a result of proposed changes in Alternatives 2- 4, such as more enforcement and monitoring of commercial use permit conditions, and instituting commercial free times and/or zones would result in a beneficial effect on wildlife by decreasing human presence in these area during certain times or seasons. Climbing Alternatives 2- 4 would not result in impairment of park wildlife resources nor the values associated with them.

Wildlife Impacts of Guided Wilderness Alternatives 2, 3 and 4

As in Guided Climbing, the same strategies listed above would be employed in these wilderness alternatives to avoid, minimize or mitigate impacts on wildlife from commercial use. As a result, even though there would initially be increased visitor use under these alternatives, over that which occurred in Alternative 1 in 2001, annual limits would cap overall use. Compared to Alternative 1, because of these strategies, commercial visitor use in Alternatives 2- 4 would have fewer impacts on wildlife.

There would be negligible effects on wildlife associated with commercial visitor use in this Alternative. Compared to the large number of independent user nights (23,260) that occurred in 2001), commercially guided wilderness visitors would constitute a very small portion of overnight wilderness visitors (2,520 user nights/396 people). Compared to 2001 use, the greatest potential for increased commercial wilderness use would occur in Alternative 2, and the least in Alternative 4 (840 user nights/144 people), while a moderate increase would occur in Alternative 3 (1,140 user nights/120 people). Nonetheless, these minor increases in commercially guided wilderness use would be negligible compared to the potential available in Alternative 1. Even with a similar number of independent wilderness visitors in future years, wilderness overnight use limits would allow for an increase of over 100,000 user nights in summer if camps were filled to capacity (see *Table 11: Total Potential Wilderness Camp Summer Visitor Use*).

Conclusion: Although compared to 2001 there would be a slight increase in commercial wilderness visitor use in all alternatives this increase would be dramatically lower than the potential for increased use in Alternative 1. Therefore, although there would be from about 26 to just over 300 more visitors, depending on the Alternative, the impacts to wildlife would remain negligible compared to existing summer overnight wilderness use. The range of impacts would be localized and the same as described above in the no action section.

Wildlife Impacts of Guided Alpine Wilderness Alternatives 2, 3 and 4

As described above for guided climbing and guided wilderness, there would be an overall increase in the number of visitors that could participate in guided alpine wilderness opportunities over 2001 use. This increase would vary by alternative and would be least in Alternatives 2 and 4 and greatest in Alternative 3 (though only slightly higher). These increases, however, would be far less than the potential increase that would exist in Alternative 1 without additional caps on existing overnight limits that could be achieved by allowing a major increase in the number of CUAs in that Alternative. Similarly, as in Alternatives 2- 4 guided wilderness above, the number of commercial visitors that could partake in these types of activities is dramatically lower than the number of independent visitors that could do the same, thus the impacts on wildlife associated with these alternatives would individually and collectively be negligible compared to existing independent visitor use.

Conclusion: There would be no impairment of wildlife or related values from the implementation of Guided Alpine Wilderness Alternatives 2- 4.

Wildlife Impacts of Additional Services Alternative 2

As noted this Alternative would allow a variety of current and new and/or enhanced opportunities for commercial services. Increasing the number of visitors who might take advantage of these opportunities could continue to cause an array of impacts to wildlife, including habituation, displacement, and direct mortality (particularly mammals and birds, but also to reptiles, amphibians and insects). The use of the above- listed management strategies to avoid or reduce impacts would also occur in this Alternative. Many of the expected impacts would be negligible to minor since most of these activities would continue to take place in existing developed areas, on roads and on designated trails and routes where impacts would be avoided by the presence of hardened surfaces, designated trails, and other features. For instance, guided day use hiking would take place along trails already well- traveled by independent and other commercial visitors. This and most other activities would add only a minor increment to the background of existing use already occurring. The exceptions are discussed in more detail below.

New Commercial Services Evaluation Process: This process would result in systematic evaluation of proposed new commercial services with respect to wildlife and other resources. Proposals that affected these resources would be modified to avoid, minimize or mitigate impacts, resulting in a negligible to minor beneficial effect. Therefore, new commercial services would likely result in additional negligible to minor impacts on vegetation and would continue to adhere to the strategies described above to minimize impacts.

Increased Winter Guided Activities: Although a wide array of winter activities are currently permitted by both the existing climbing concessioner and the food, gift and lodging concessioner, few of these activities occur regularly. Under this Alternative, these activities would likely occur with greater regularity and with increasing frequency. There could be a dramatic increase (from less than 100 people in 2001 to over 27,000 people in this Alternative) in the number of visitors that could take advantage of these opportunities. It would be unlikely, however that this maximum would be met due to limited areas for conducting activities, special conditions associated with permits and variable weather conditions. In addition, since these opportunities, would only include day use, however, most visitors would be recreating primarily within or near developed areas, where access to such services would occur (in addition, these areas would be close to plowed roads, where vehicles could congregate for access). Impacts would primarily be from noise and disturbance associated with congregation and dispersal of visitors for these activities. When compared to existing annual visitation, increasing winter visitation near developed areas would result in minor to moderate impacts on wildlife. Impacts associated with Alternative 2 would be similarly dramatically lower than potential impacts associated with Alternative 1, where an potential major increase in the number of CUAs could be issued for winter day use activities.

Westside Road Shuttle**:** Instituting a shuttle on the Westside Road could result in more disturbance and displacement of wildlife on the west side of the park. Although access to this area was popular throughout the early history of the park, it has not been widely used since the first road closure in 1988. As a result, wildlife in the area has likely become habituated to an increasingly minor to moderate degree of visitor activity than would be possible under this Alternative. Over time, species have likely moved activity areas closer to the closed road, which is primarily used only in summer for occasional administrative vehicle access. Under this Alternative the road would be rehabilitated and used regularly for shuttles transporting visitors. Therefore trailheads that now take a long hike to reach would be easily reached and use and access would increase substantially. There would also be increased access and use of areas surrounding the road by independent and commercial visitors and park staff. More routine road maintenance and improvement activities would increase the amount of wildlife disturbance along this current relatively quiet corridor. The increase in noise and disturbance associated with new ongoing maintenance and use of this road would have a moderate localized effect on wildlife habitat use and activity patterns in the vicinity of the road. This impact would be similar to, but

less than the former level of activity along this road historically, when the road was open to all private vehicle traffic.

Conclusion: As in Alternative 1, there would continue to be negligible to moderate localized adverse effects on wildlife habitat use (particularly mammals and birds) associated with commercial services. These would be greatest in Alternative 1 and least in Alternative 2. No impairment of park wildlife or wildlife related values would result.

➢ SPECIAL STATUS SPECIES

Special Status Species Impacts of Climbing, Wilderness, Alpine Wilderness and Additional Services Alternative 1

ONGOING VISITOR AND ADMINISTRATIVE USE: The primary effects on special status species from the actions under this Alternative would be related to noise or disturbance associated with visitor and administrative use and other impacts as described above in the general wildlife section. For the most part these effects would be minimal, due to the distance of human activities from known nesting activity sites and because the primary visitor use activities do not result in loud noises. Occasionally, however, nesting activities are found near designated wilderness camps or trails or other developed areas. When that occurs, if possible, closures are enacted and/or areas are monitored more consistently.

In early spring and late fall, there would continue to be helicopter re- supply and human waste removal flights to Camps Muir, Schurman for barrel placement and removal. These flights now originate from helispots located above the elevation of both nesting northern spotted owls and marbled murrelets or from a helibase not located in suitable nesting habitat. Under this and other alternatives, these flights would continue to be restricted in this manner. The late season flights also generally occur in the late nesting season (often in late September). Park guidelines call for helicopter flights in northern spotted owl/marbled murrelet habitat from March 1 to August 6 to remain 5,200 feet above the canopy and from August 6 to September 30 to remain 2,600 feet above the canopy. This guideline has been approved in consultation with the USFWS. In addition, where marbled murrelet nesting or activity has been documented, park administrative activities are limited to the period from 2 hours after sunrise to 2 hours before sunset. As a result, during the nesting season, helicopter flights and other noisy administrative uses would continue to be restricted in known nesting areas (which would continue to be assessed through ongoing demographic surveys), would remain restricted to the aforementioned elevations above the forest canopy and would continue to be not likely to adversely affect northern spotted owls and marbled murrelets. During other periods (October – February), these restrictions do not apply and there would be no effect on marbled murrelets or northern spotted owls from helicopter operations.

See below for specific impacts to other listed species.

Special Status Species Additional Impacts of Guided Climbing, Wilderness, Alpine Wilderness Alternatives 1-4 and Additional Services Alternatives 1-2

Northern Spotted Owl/Marbled Murrelet/Bald Eagle/Peregrine Falcon

The primary effects on these species would be as a result of periodic noise and disturbance related to ongoing visitor and administrative use, primarily with respect to infrequent loud noise from helicopter operations. Since these operations occur under a rigorous set of limitations as defined above in Alternative 1, these would continue to be not likely to adversely affect northern spotted owls and marbled murrelets from March through September and would continue to have no effect from October through February. Since there is no nesting of bald eagles within the park and since helicopter operations do not affect known peregrine nesting habitat, there would be no effect on these species.

Fish/Amphibians

There are no specific actions related to commercial services identified in Alternatives 2- 4 that would result in adverse effects on fish or amphibians, that would contribute more sediment to park waters, or that would result in adverse effects on park water quality. There would continue to be only negligible indirect effects in localized areas associated with vegetation trampling that would have no effect on threatened or endangered fish, including Chinook, bull trout, dolly varden, coho, cutthroat trout, steelhead or other aquatic species.

Gray Wolf / Grizzly Bear/ Pacific Fisher/ Canada Lynx/ California Wolverine

These species, many of which have large or very large home ranges, have been extirpated from (gray wolf, Pacific fisher, Canada lynx, California wolverine) or have never been documented in (grizzly) the park. Recent parkwide forested/subalpine elevation camera bait station and lynx hair snare surveys for small and medium- sized carnivores have not detected any of the above species to date.

Gray Wolf: Gray wolves are considered extirpated. They have not been detected since the 1920s but numerous observations exist from the late 1800s through that period. Even so, there have been relatively recent reliable observations of gray wolf west and east of the park. Nearly all detections of gray wolves on the east side of the park have been determined to be hybrids introduced in the late 1980s, although wolves are considered to be moving south into Washington from known populations in Canada. Because the actions proposed in this Environmental Assessment would not result in habitat removal or modification beyond that which has already occurred in park developed areas, because there are no actions that would affect wolf prey species, because no additional roads would be plowed or opened to winter use, the alternatives would be not likely to adversely affect wolves.

Lynx: Lynx were also noted from the park as recently as 1934. Relatively recent observations have indicated the presence of lynx east of the park. Suitable habitat and the lynx's primary prey species (snowshoe hare) has been identified in the northeast section of the park. For the same reasons as indicated above under Gray Wolf and because there is no additional use proposed in lynx suitable habitat, the alternatives herein would be not likely to adversely affect lynx.

Grizzly Bear: A one time reliable observation of grizzly tracks in the Puyallup River watershed occurred in 1993. No grizzlies have been detected before or since in the vicinity of the park. In fact, grizzly bears have never been documented from the park, despite its establishment in the late 1800s. There would be no effect on grizzly habitat or prey or the animal itself as a result of the alternatives in this Environmental Assessment.

Pacific Fisher and Wolverine: The alternatives in this Environmental Assessment do not propose the removal of habitat for these species, and the effects of the actions proposed herein would occur widely spaced over time and distance (throughout the park) in areas already frequented by visitors. As a result, because the alternatives would not result in other effects on other life habitat requirements for these species and because they have not been detected in recent targeted surveys, there would be no effect on these species.

Other Sensitive Species

No specific impacts other than noise and disturbance similar to ongoing visitor use activities to other sensitive species listed in Table 3 have been identified that would be directly or indirectly related to the Alternatives contained in this Environmental Assessment. These species would not be affected by proposals contained in Alternatives 1- 4 herein.

Conclusion: There would continue to be no effect on most sensitive, rare, threatened, or endangered species. Some species though could continue potentially be affected by ongoing helicopter operations and other noisy activities associated with park operations. The actions associated with managing commercial visitor use would continue to be not likely to adversely affect northern spotted owls, marbled murrelets, gray wolves, and lynx. There would be no effect on bald eagles, peregrine falcons, grizzly bears, fishers, wolverines or other threatened or endangered fish.

There would be no impairment of sensitive, rare, threatened or endangered species or the values associated with these species as a result of the actions proposed in this Environmental Assessment.

➢ PREHISTORIC AND HISTORICAL ARCHEOLOGY

Prehistoric and Historic Archeological Impacts of Climbing, Wilderness, Alpine and Alpine Wilderness and Additional Services Alternatives 1
There would be no additional impacts or impairment of prehistoric or historic archeological resources as a result of these Alternatives. None of the alternatives would result in alteration of subsoil resources. No impairment of prehistoric or historic archeological resources or their values would occur.

Prehistoric and Historic Archeological Impacts of Climbing, Wilderness, Alpine Wilderness Alternatives 2-4 and Additional Services Alternative 2
In these Alternatives, especially in Climbing Alternatives 2- 4, in alpine areas that become snow free, routes would be designated beyond currently designated trails. Most of this route designation would be on previously existing way trails. In other alpine areas, overnight campsites would be designated to avoid occasional use of many areas by concentrating use in a few areas. In Additional Services Alternative 2, there would be minor improvements, such as grading and roadside vegetation removal made to the Westside Road to improve the road for public shuttle use.

Upon identification of these routes or sites, including the work on the Westside Road and the trail designation in late season snow free alpine areas, specific environmental analysis (prior to beginning work) would include archeological and other resource surveys. If prehistoric or historic archeological resources were discovered during any portion of a proposed action, work in the area associated with the find would cease until evaluated by the park archeologist or designated representative. If necessary or possible, relocation of the work to a non- sensitive area would occur to enable more site testing and documentation. Every effort would be made to avoid further disturbance to the site.

As a result, effects on archeological resources would remain negligible and would not result in impairment.

➢ ETHNOGRAPHIC RESOURCES

Ethnographic Impacts of Climbing, Wilderness, Alpine Wilderness Alternatives 1-4 and Additional Services Alternatives 1-2
There would be no effect on or impairment of any known ethnographic resources as a result of the alternatives described herein. None propose use where use is not already occurring, nor would any change current Native American use of existing areas.

➢ HISTORIC STRUCTURES/CULTURAL LANDSCAPES

Historic Structure/Cultural Landscape Impacts of Climbing Alternative 1
Under this alternative, the climbing concessioner would continue to be assigned facilities at Camp Muir, including the Cookhouse (1916), a pit toilet, and the Bunkhouse (Gombu/client shelter). (As of 2003, use of the Paradise Guide House for office and equipment rental space was removed from the current contract.) Of the currently assigned structures, only the Cookhouse is a historic structure. It is listed on the National Register of Historic Places as contributing to the Camp Muir Historic District and the Mount Rainier National Historic Landmark District.

Under current and future contract requirements, derived from NPS Management Policies, concessioners are required to maintain the facilities they are assigned. Such maintenance is required to result in no adverse effect to historic properties and to be documented via the park's National Environmental Policy Act and National Historic Preservation Act (Section 106) process. According to Management Policies (Chapter 10.2.4.9): "Concessioners are required to comply with applicable provisions of all laws, regulations and policies that apply to natural and cultural resource protection. . . The use, maintenance, repair, rehabilitation, restoration, or other modification of concession facilities that are listed on or eligible for the NRHP are subject to the applicable provisions of all laws, Executive Orders, regulations, and policies pertaining to cultural properties." As a result, there would continue to be ongoing actions to maintain concessioner assigned historic (and other) structures that would be evaluated against existing law and policy and that would be limited to actions that seek to preserve, maintain or rehabilitate the structures. Alternative 1 would continue to have no adverse effect on historic structures and cultural landscapes and therefore would not result in impairment to these resources.

Under this Alternative, the food and gift service concessioner would continue to be assigned the same facilities it now operates or uses in the park, including the National Park Inn, Longmire General Store, Paradise Inn, Paradise Glacier Dorm and a variety of other housing, including the Paradise Guide House, and Longmire houses: L125, L126, L140, L141, and L110.

Historic Structure/Cultural Landscape Impacts of Guided Wilderness, Alpine Wilderness and Additional Services Alternative 1

There would be only occasional commercial use of historic structures under these Alternatives and no effect on these structures from such use. No structures would be assigned to commercial services under these Alternatives and none would have other than incidental use during normal operations.

Historic Structure/Cultural Landscape Impacts of Guided Climbing Alternatives 2-4

Under a current draft plan for the rehabilitation of Camp Muir facilities, the park is contemplating a variety of options for Camp Muir. Among the options being considered are the following:

- No action
- Improving interpretive information (from Paradise to Camp Muir)
- Stabilizing ongoing erosion of the site
- Improving public access pathways
- Improving, relocating or removing the snowmelt water system
- Retaining the current or constructing new toilets
- Improving ventilation in the public shelter (possibly adding a cooking alcove)
- Replacing the Gombu/client Shelter
- Considering new functions for the historic cookhouse and old men's comfort station
- Possible construction of new facilities, including a ranger sleeping, cooking and/or public contact facility.

Options chosen would depend on a variety of factors, including the outcome of this Commercial Services Plan/Environmental Assessment and public comment on that draft plan. Regardless of the alternative selected, however, an underlying premise of both this Commercial Services Plan/Environmental Assessment and the draft Camp Muir [Development Concept Plan]plan is that the historic structures at Camp Muir would continue to be preserved to ensure that park actions would have no adverse effect on their contribution to the Mount Rainier National Historic Landmark District or on the individual or collective eligibility (Camp Muir Historic District) of the structures on the National Register of Historic Places. All alternatives would include a series of specific, basic rehabilitation measures that would increase the preservation maintenance of the historic structures at Camp Muir.

Under these alternatives climbing concessioners could be assigned joint occupancy of facilities such as the Camp Muir cookhouse, public shelter and/or other structures. Impacts would be the same as Alternative 1.

Historic Structure/Cultural Landscape Impacts of Guided Wilderness and Alpine Wilderness Alternatives 2-4
Most actions called for by Alternatives 2- 4 would have no effect on historic structures or cultural landscapes. The removal of the Gombu/client shelter would, under all alternatives, have a long-term moderate beneficial effect on the contribution of the area to both the Camp Muir Historic District and the Mount Rainier NHLD.

Historic Structure/Cultural Landscape Impacts of Additional Services Alternative 2
Only the rehabilitation of the Westside Road to serve as a shuttle route and the disposition of the current concession- operated facilities at Camp Muir would result in potential effects to historic structures and the Mount Rainier NHLD. Improvements to Westside Road to accommodate a visitor shuttle would include a variety of actions to increase the road's driving surface. These would include a series of cyclic maintenance actions such as brushing, grading, rock wall repair, and other activities that have not been a priority since the road was closed to all but administrative traffic in 1988. These actions would conform to the road's inclusion on the National Register as part of the Mount Rainier National Historic Landmark District and would result in improving the condition of the road. None would have an adverse effect on the road as a contributing structure to the NHLD or on the NHLD itself.

Conclusion: As a result, the actions called for in Alternatives 2- 4 of this Environmental Assessment would result in no adverse effect and therefore no impairment to historic structures or cultural landscapes.

➢ VISITOR EXPERIENCE

This section contains evaluation of the occasionally overlapping characteristics of visitor use opportunities and visitor access and enjoyment.

Visitor Experience General Impacts of Guided Climbing, Wilderness, Alpine Wilderness and Additional Services Alternatives 1
Expansion of CUAs: In these Alternatives, there would initially be no changes to visitor use opportunities or visitor access and enjoyment, including no changes to the origin of visitors or to the peak visitor use season. Later, however, as the number of CUAs increased, there would be an increase in the number and type of commercial services and an ongoing, long- term increase in the number of people who could take advantage of these services. This would result in a long-term minor to moderate adverse impact to visitor access as the ratio of independent visitors decreased against a background of increasing commercial visitors and slightly increasing annual park visitation.

Day use activities would offer the most room for expansion, since there are currently no limits on day use. As expansion occurred, sunny summer days, when crowding of park facilities is evident, would likely be most affected. This effect would be minor initially, but could become major with continued expansion of these activities.

Overnight use would continue to have upper limits as defined in the Wilderness Management Plan. These limits would prevent unlimited expansion of overnight commercial activities, however, since the park does not have a guideline that regulates the percentage of commercial versus independent use, as commercial use rose, it could adversely affect opportunities for independent visitor use. As commercial use increased, it would become more difficult to obtain wilderness campsites on a first- come, first- served or reservation basis both for other commercial services and for independent visitors. Without limits on these services this could eventually result in a moderate adverse effect on visitor use opportunities and access in wilderness, including low elevation and upper mountain experiences.

Regulation of Visitor Use Activities: Regulation of commercial and independent visitor use would continue to reduce impacts to park resources. In these alternatives, compared to the action alternatives, there would be few limitations on commercial visitor access. Currently all park areas are open to commercial use and while wilderness regulations exist for independent groups in wilderness, they have not been applied to commercial groups. In these alternatives, there would be no learning curve for commercial visitors or businesses trying to understand new regulations. The Westside Road would remain closed to vehicle access until a proposal to implement the GMP called for shuttle service arose.

The same strategies, to avoid, minimize or mitigate impacts to park resources would continue to be used. While minor changes would continue to be made via annual operating agreements, major changes would not occur. Over time, although restrictions would be added on a case- by-case basis to prevent impacts to park resources detected by ongoing oversight of permits and contracts, there would be no sweeping changes. As a result, impacts to park resources now occurring would continue. This would result in minor to moderate, primarily localized adverse impacts on the quality of the visitor experience when those impacts (such as trampling or braided social trails) that could be attributed to commercial use were observed or experienced.

Conclusion: These alternatives could result in long- term minor to moderate or major adverse effects on visitor access and opportunities as the ratio of commercial to independent visitors decreased. This would primarily affect independent visitors. There would be accompanying minor beneficial effects related to the initial expansion of CUAs, but long- term minor to moderate adverse effects from the continuing expansion. There would be no impairment of the visitor experience pending updates to the Wilderness Management Plan limits and/or the establishment of a Carrying Capacity Plan.

Visitor Experience Impacts of Guided Climbing Alternative 1

Competition and Choice: Alternative 1 would also continue to result in the least degree of competition among companies and the least choice for visitors in guided climbing on the Muir Route and Other Routes, since there would continue to be one primary guided climbing concessioner. CUAs would continue to be issued for guided climbing on the Emmons Route until wilderness overnight use caps were met. Depending on the number of CUAs issued, this could have a moderate adverse effect on the ratio of independent to commercial use on this route as more CUAs resulted in fewer independent visitors being able to reserve or obtain overnight campsites on this route. By the same token, however, increases in guided climbing opportunities on the Emmons Route would result in a minor beneficial effect on both CUA businesses and potential clients on the Emmons Route, where the small number of climbs now offered fills to capacity nearly as soon as advertised. More climbs would be offered on the Emmons Route, thereby resulting in a higher degree of competition and choice.

Maximum Number of Trips: Because there are higher maximums for the concessioner in Alternative 1, it would offer the greatest potential for expansion of climbing opportunities and therefore, potentially the greatest number of trips on the Muir, Kautz and Other climbing routes. Because Alternative 1 would also offer the fewest restrictions on the number of CUAs that could be issued, it would also offer the greatest number of trips on the Emmons Route and in the guided wilderness and guided alpine wilderness categories.

Visitor Experience Impacts of Guided Wilderness Alternative 1

Competition and Choice: This Alternative would result in a wide array of new commercial services offered in park wilderness, thereby possibly having a moderate effect on increasing competition among commercial wilderness trip service providers and increased choice in the types of trips offered.

Expansion of CUAs: The displacement of independent overnight wilderness visitors in favor of commercial overnight visitors would likely be greatest under this Alternative since public independent backpackers constitute the majority of use and under current visitor use it is difficult for visitors (in the peak season) to obtain some popular wilderness campsites needed to complete their Wonderland Trail trips. As a result, ongoing increases in guided wilderness CUAs would

result in a negligible to major effect on independent backpackers, depending on the camp or zone.

Visitor Experience Impacts of Guided Alpine Wilderness Alternative 1
Competition and Choice: Impacts associated with competition and choice in this Alternative would be the same as described above for Guided Wilderness Alternative 1.

Visitor Experience Impacts of Additional Services Alternative 1
Commercial Services Evaluation Process: Under this alternative, new commercial services would continue to be evaluated on a case- by- case basis. Under the current process, they would be approved pending analysis of their appropriateness in the park and on administrative factors such as verification of licensing and permits held by the proposed business operator(s). As needed, environmental impact analysis would be used to answer questions about potential impacts or as new services were proposed.

Frontcountry Group Camping: Ongoing regulation of commercial frontcountry group camping would continue to result in some campsites being booked illegally, since the demand for group camping in the frontcountry far exceeds its availability. This would continue to result in a negligible to moderate impact on commercial groups trying to reserve campsites in the park.

Conclusion: The rise in commercial use associated with Alternatives 1 could have minor to major adverse impacts on independent visitor use opportunities, primarily as a result of essentially uncontrolled expansion of CUAs. Ongoing regulation of visitor use would result in both minor to moderate beneficial and adverse effects on both commercial and independent visitors. Although there is a possibility of impairment with respect to commercial visitor use on independent visitor use, it is likely that this would not occur due to existing overnight use limits. Increasing the number and diversity of day use opportunities, however, could eventually result in impairment if ongoing expansion of CUAs were to continue without revision to the Wilderness Management Plan or development of a Carrying Capacity Plan. This effect would likely only occur on peak summer days when the park is already crowded.

Visitor Experience General Impacts Associated with Guided Climbing, Wilderness, and Alpine Wilderness Alternatives 2-4 and Additional Services Alternative 2
In general many of the characteristics of the Guided Climbing, Guided Wilderness, Guided Alpine Wilderness and Additional Services action alternatives are the same. These similar characteristics include how the alternatives would be regulated to protect resources, including more common to all and new strategies for group sizes, shuttling of clients and guides, and other factors.

Regulation of Visitor Use to Protect Resources: Applicable to all of the action alternatives are a suite of strategies that would limit effects on a variety of park resources, including air and water quality, vegetation and wildlife. These are listed by resource area above (see earlier impact analyses sections). These more specific requirements for park commercial service providers, would result in more oversight of commercial activities, and an increasing ability to avoid impacts to park resources before they have an opportunity to occur. Some of these include:

- establishing standard commercial services client to guide ratios depending on the type of activity
- offering a variety of expanded or new commercial visitor use opportunities
- establishing visitor use limits for existing and new or expanded commercial service opportunities.
- limiting commercial use on summer weekends and/or in some sensitive areas
- limiting commercial groups to one night stays in any one camp or zone per trip (except Muir, Emmons and Kautz and for Guided Alpine Wilderness trips, as well as some alpine climbing zones where summit attempts take longer),
- requiring rather than encouraging minimum impact techniques be taught during appropriate activities,
- requiring National Park Service mission orientation training for commercial guides, and

- increasing the number of concessioners and CUAs to augment competition for services.

Group Size: While current overnight group size (15) on the Muir, Kautz routes exceeds the Wilderness Management Plan group size limit, it would be modified under this and other Alternatives to conform to Wilderness Management Plan limits (12) via changes to the new concessioner contract.

Increased Number of Guided Groups: Increasing the number of guided groups would result in more visitors learning more about park resources, benefiting from a guide's experience and training and the requirement that they teach minimum impact techniques, such as Leave No Trace. Guided activities tend to:

- enhance visitor appreciation of park values through education of visitors by a knowledgeable guide
- facilitate and complement the fundamental experience of park visitors through the enhancement of a quality park experience
- provide a more in- depth educational experience than visitors might gain through reading materials
- experienced guides can provide an increased margin of safety for those wanting to participate in more adventurous recreational activities
- provide an in- depth LNT experience that visitors can use in future experiences (NPS N.D.).

This may result in fewer impacts to park resources being observed by other commercial and independent visitors, resulting in a long- term minor beneficial effect on visitor enjoyment of park experiences.

Client to Guide Ratios: Establishing minimum guide to client ratios would increase the ability of guides to respond to emergencies, to control impacts of their groups on park resources, and would increase the margin of safety associated with guided groups. These would have a long-term negligible to minor beneficial effect on both commercial and non- commercial park visitor experiences.

Expanded and New Commercial Services Limits: Expanding some current activities and offering a variety of new opportunities with upper limits (some preliminary) for each of the new or expanded opportunities would reduce the ability of commercial services to have adverse effects on park resources. Coupled with the new limits would be better tracking of commercial services and better training of guides and therefore clients. The limits would be reevaluated as needed (through monitoring) to limit potential adverse impacts to park resources.

Limiting Use in Sensitive Areas and During Peak Periods: Although the areas where use is limited or regulated vary among alternatives (see differences among alternatives below for specifics), further regulating commercial visitor use would result in a beneficial effect on park resources and thus a long- term beneficial effect on the visitor experience by increasing the number of areas where visitors find area resources in good condition.

Limiting Commercial Use in Any One Camp or Zone: In summer, both independent and commercial visitors have difficulty in obtaining their first choice camps. This is especially true where route or trail limitations limit the availability of overnight camps. Limiting commercial groups to one group in any one camp or zone (with the above noted exceptions) and limiting stays to one night (again, with exceptions), would result in a beneficial effect on the overall overnight independent visitor experience and a minor adverse effect on commercial groups (who reserve their spaces in advance of the public reservation process).

Increased Competition: Overall, increasing competition among commercial operators by changing the number of concessioners among the alternatives and varying the number of CUAs among the alternatives would result in better services to park commercial visitors by fostering competition among these businesses for service to park visitors. At the same time, increasing the number of commercial operators or the dispersion of available service area(s) for concessioners would result in more choice for visitors, thus increasing the range of the types of climbs available.

New or Expanded Commercial Visitor Use Opportunities: There would be no changes in the origin of park visitors, peak visitor use season, major facility changes or restrictions on independent public day use under these alternatives. There would, however be changes in the number of guided visitors participating in commercial activities, including climbing, wilderness and alpine wilderness use, day hikes, bicycle tours and other activities. These alternatives would initially offer an increase in the ratio of guided commercial over non- guided independent groups. This increase would be capped at various levels depending on the type of visitor use activity (i.e. day hiking or climbing). Collectively, these changes in numbers of commercially guided visitors, although they vary among alternatives, would result in a negligible to moderate adverse or beneficial effect on the independent visitor opportunities and access. The range of this effect would depend on the tolerance of independent visitors who encountered more commercial activities in the park or who were affected by the activity in question. It would also depend on whether or not these visitors would take advantage of new visitor use opportunities offered by park commercial services.

Conclusion: Combined, these new management strategies would result in a long- term beneficial effect to park resources by preventing resource (including visitor use and park operations) impacts that would otherwise occur in the absence of these guidelines, therefore resulting in a better perception of park resources by most visitors and improving the overall visitor experience.

Visitor Experience Differences Among Alternatives

These alternatives vary in the following characteristics described more specifically below. They:

- offer varying numbers of concessioners or CUAs to provide the above services,
- establish different use levels for guided climbing on the primary climbing routes, guided wilderness and guided alpine wilderness
- offer a different array of flexibility to the commercial services that would provide these trips,
- allow commercial use in different areas of the park
- differ in the numbers and/or types of trips available, and
- offer different opportunities

Individually and collectively these differences result in a variety of impacts to the visitor experience.

Visitor Experience Impacts of Guided Climbing Alternatives 2-4

Competition and Choice: With its three equal concessioners, Alternative 3 would offer the greatest degree of competition and choice on all routes as well as among concessioners. Alternative 2 with one concessioner on the Muir Route and four Emmons, Kautz and Other concessioners would not increase competition among concessioners on the Muir Route, but would be likely to increase competition on the Emmons, Kautz and Other routes since concessioners on these routes, depending on their target public would likely be competing with each other for clients. Alternative 2 would also increase the range of routes available for guided climbing. With essentially one concessioner on each major route, Alternative 4 would offer the least degree of competition and choice among concessioners per route. With one Muir and Other concessioner and one Emmons, Kautz and Other concessioner, this alternative would offer choice within concessioner services (similar to Alternative 1) once the destination had been selected.

Commercial Use Limits/Flexibility: Overall, these alternatives would offer increased guided climbing on the Emmons, Kautz and Other routes and increased flexibility for guides to offer different length summit trips. All trips associated with these alternatives, however would be summit attempts. Concessioners would no longer offer an array of non- summit mountaineering skills courses (other than the Mountaineering Day Schools). These opportunities would have a negligible beneficial effect on visitor opportunities by increasing the diversity of guided climbing on Mount Rainier. Because the number of Mountaineering Day School participants would vary among the alternatives, there would be variations in the length and type of trips that could be accommodated by each alternative. Alternative 3 would offer the greatest flexibility and Alternative 2 the least, with some climbers in Alternative 2 having to obtain skills training elsewhere or being accommodated on longer summit climbs (with two night stays at Camp Muir).

Without training elsewhere and with longer summit climbs, fewer clients would likely be accommodated in this Alternative compared to Alternatives 1, 3, and 4.

Commercial Free Areas/Times: With camping in all camps and zones, except the Muir Snowfield, Alternative 2 would result in the least impact and greatest flexibility for commercial services, but the greatest impact (minor to moderate) on independent climbers who could encounter commercial groups throughout the park. Alternative 2 would also continue to allow concessioner climbing on the Muir Route and Other Routes to include weekends, the Emmons Route (similar to Alternative 1) would remain commercial free on weekends, while the Kautz Route would also become commercial free on weekends.

Alternative 3 would also limit Muir Route use to Camp Muir (again eliminating Muir Snowfield camping for commercial groups as well as Alpine Nisqually and Ingraham Flats) and would further restrict commercial use in some areas. Alternative 3 would contain the same timing restrictions as Alternative 2 with respect to the Muir, Emmons, Kautz and Other route use but collectively would have the greatest effect on commercial services and the least on independent climbers. Single Trip Guides, however could use all but the Kautz Routes on weekends.

Alternative 4 would limit commercial guided climbing on the Muir Route to Camp Muir and Ingraham Flats (without the Muir Snowfield and Alpine Nisqually zone). Alternative 4 would also limit commercial climbing in some areas. Alternative 2 would have the fewest restrictions and Alternative 3 the most. Alternative 4 would continue weekend use on the Muir Route, and open the Emmons Route to weekend use, while keeping Kautz and Other Routes commercial free on weekends. As in Alternative 3, Single Trip Guides could use all but the Kautz Route on weekends.

There would be more visitors regularly traversing some areas of the park, such as the ongoing daily climbs on the Muir Route, and the increase in climbs on the Emmons and Kautz Routes. These impacts would be most obvious in Alternative 4 on the Emmons Route, where daily climbs are then possible by one concessioner. For the most part, however, given the continued overall small number of commercial visitors against a rather large background of independent public use, except with respect to climbing on some routes, these impacts would be negligible. On some climbing routes, including the Muir Route, continued use by approximately 50 percent commercial visitors would continue to have a moderate intermittent effect on independent climbers expecting less use during the summer.

There would be a minor beneficial effect on independent climbers in Alternative 2 and a minor to moderate beneficial effect in Alternatives 3 and 4, on independent climbers who would enjoy some commercial free zones or times and a negligible to minor adverse effect on commercial visitors who might feel excluded from routes they would otherwise enjoy. The beneficial effect and adverse effects would be greatest in Alternative 3 and least in Alternative 1. The restriction on commercial camping on the Muir Snowfield would be a minor adverse effect on some commercial visitors' experiences. By the same token, it would also result in a minor beneficial effect on independent visitors who might feel less crowded during Snowfield camping experiences.

Expanded Opportunities: Alternative 3, like Alternative 4 adds another new commercial visitor use opportunity – Single Trip Guides. Climbing guides not connected to a business in the park (concession or CUA) could lead small groups on both winter and summer summit climbs. (Under Alternative 1 only current guide services could provide this service. Alternatives 3 and 4 open guiding to other guide services with this CUA.) This opportunity would have a negligible beneficial effect on visitor use access, increasing the range of opportunities with which the public could experience a guided summit climb and increasing the availability of guiding on Mount Rainier to other experienced guides. Single Trip Guides would offer an expanded opportunity for summit and non- summit mountaineering by non- concession non- IBP guides, including by commercial guiding by small and international businesses

Number of Trips: Alternative 2 would offer many fewer trips than Alternative 1 on the Muir Route and (at least initially) more trips on the Emmons, Kautz and Other Routes. Alternative 2 would offer the same number of trips as Alternative 3 on the Muir, Emmons, and Kautz Routes and the greatest number of trips on Other Routes, thus having a moderate effect on increasing commercial visitor use opportunities.

Holding the level of commercial use on the Muir Route to (Alternatives 2 and 3) or lower than (Alternative 4) that currently occurring on this route would result in a long- term negligible impact to park concessions, while offering a long- term beneficial effect on the non- guided public visitor experiences. Numerous visitors have complained of overcrowding on the Muir Route. Increasing guiding on the Emmons and other routes as noted above would increase the availability of these opportunities to park visitors, thereby having a minor beneficial effect by enhancing the experiences of some commercial park visitors, especially on the Emmons Route, where climbs now fill, almost on the day they are advertised by the current IBP holders.

Conclusion: All alternatives would offer differing amounts of competition and choice among concessioners and flexibility in the types of climbs, with Alternative 3 offering the greatest after Alternative 1. Alternative 3 would offer the most commercial free areas, and Alternative 2 the most commercial free times, therefore having a minor effect on limiting access by some potential commercial visitors, but expanding the range of areas or times when independent visitors would not encounter commercial climbers. There would be moderate intermittent effects on independent visitors from daily commercial climbs on the Muir Route in all alternatives (however, these would be held to a use cap in Alternatives 2, 3 and 4) and from more frequent climbs on the Emmons and Kautz routes. Alternatives 3 and 4 would offer expanded opportunities to independent commercial guides. There would be a variety of minor to moderate beneficial and adverse effects visitor experience access and enjoyment from Alternatives 2- 4. No impairment of the visitor experience or the values associated with it would occur.

Visitor Experience Impacts of Guided Wilderness Alternatives 2-4

Competition and Choice: Depending on the type of client catered to by each Wilderness CUA, these alternatives would offer a range of competition and choice for visitors seeking guided wilderness trips – Alternative 3 (5 CUAs) would offer the greatest and Alternative 4 (2 CUAs) the least for Guided Wilderness. For Guided Alpine Wilderness, Alternative 4 (10 CUAs) would offer the greatest choice and Alternative 2 the least (5 CUAs). Increasing the number of CUAs offering similar services in all alternatives would likely increase either the diversity of activities offered or the range of competition for similar trips.

Commercial Use Limits/Flexibility: Next to Alternative 1, Alternative 2 would provide the greatest degree of commercial use and flexibility in terms of the types of guided wilderness trips and number of trips offered. Unlike other Alternatives, Alternative 2 would also allow the use of cross- country areas by small groups in summer as well as winter. In this Alternative up to one trip could be on the Wonderland Trail and two on the Northern Loop trail. Compared to the 10 trips offered by Alternative 3 and the 12 trips offered in Alternative 4, the 33 trips in Alternative 2 would likely result in more variety for visitors. Alternative 3 would be the most limited in terms of flexibility for the commercial service because it would limit each of the 5 CUAs to one trip in summer and one trip in winter. This would result in a negligible to minor adverse effect, with the limited choices available in scheduling wilderness trips for both concessioners and visitors.

Commercial Free Areas/Times: While all trails and camps would be available for guided wilderness trips, limiting summer weekend (Friday and Saturday night) use of two commonly crowded wilderness camps (Indian Bar and Summerland) in Alternatives 2- 4 would increase the availability of these camps to independent park visitors and provide a minor long- term beneficial effect on independent park visitor experiences during the peak season. At the same time there would be a negligible adverse effect on commercial visitors' unable to use these camps on weekends. Alternative 3 would not offer summer weekend use, resulting in a negligible adverse effect on visitors who could only take trips on weekends. At the same time, Alternatives 2 and 4 would not offer trips that included summer weekends on the Northern Loop trail, having the

same effect. In winter, the restrictions would ease and winter trips and cross- country use on snow (both travel and camping) by large and small groups would be permitted, thereby increasing the flexibility offered to visitors and concessioners.

Expanded Opportunities: Alternatives 2- 4 call for guided wilderness trips to occur in both summer and winter, whereas in Alternative 1, they occur only in summer. Each alternative also offers a slight to moderate expansion in the number of visitors who could take advantage of guided wilderness trips, resulting in a beneficial effect on a small portion of park visitors desiring a guided wilderness trip.

Number of Types of Trips: Alternative 3 would offer the fewest guided wilderness trips (10), with an increasing number of trips offered by Alternative 4 (12), Alternative 2 (33) and Alternative 1 (unknown – based on camp availability and competition with the public). Alternative 2 would likely offer the greatest degree of choice in types of trips, while Alternative 4 would likely offer the least (with just two CUAs). All would have a minor beneficial effect on increasing the array of guided wilderness opportunities now available to visitors.

Conclusion: There would be no impairment of visitor experience access and enjoyment from the implementation of Alternatives 1- 4.

Visitor Experience Impacts of Guided Alpine Wilderness Alternatives 2-4

Competition and Choice: Although there would be fewer opportunities for a climbing concessioner to lead non- summit mountaineering skills training in Alternatives 2- 4, there would be more opportunities for others to do so, resulting in potentially greater collaboration among park commercial services and increased competition and choice for park visitors when deciding upon a guided alpine wilderness experience. Alternative 4 would result in the greatest potential for competition with 10 CUAs (although having only two trips each may limit any potential for competition among CUAs), while Alternative 2 would offer the least CUAs (5) with four trips each.

Commercial Use Limits/Flexibility: While most other guided wilderness and climbing trips would be limited to one night's stay in any one camp or zone, Guided Alpine Wilderness trips would be available for up to 4- nights in the Alpine Nisqually and Alpine Winthrop areas. This would increase visitor use opportunities for a variety of educational snow and ice skills courses to be offered.

Expanded Opportunities: Alternatives 2- 4 offer an expansion of existing concession and IBP-mountaineering skills courses now offered on the Winthrop and Nisqually Glaciers. This expansion would result in a beneficial effect on some visitors' experiences by providing more opportunities to learn wilderness snow and ice skills.

Conclusion: There would be no impairment of visitor experience access and enjoyment from the implementation of Alternatives 1- 4.

Visitor Experience Impacts of Additional Services Alternative 2

As in other alternative analyses described above, this Alternative would incorporate a variety of management strategies to reduce impacts on a variety of park resources, resulting in better condition of park resources and a better visitor experience.

Competition and Choice: Alternative 2 would offer increased competition for both new and old commercial services, including guided day hiking, guided winter activities, bicycle tours, shuttles, towing services, Muir Winter Guides, mountain ski circumnavigations, and other services since there would be an increase in the range of services offered, resulting in a positive beneficial effect on visitor choice over Alternative 1.

Commercial Free Areas/Times: There would be no change in the array of routes available for existing commercial services. In the absence of park restrictions, all park trails and roads would be open to Additional Services CUAs.

Expanded Commercial Services: This Alternative would result in an expanded array of visitor opportunities for current commercial services, including:

- increased opportunities for skills instruction
- broader authority to authorize a wide variety of towing companies to serve visitors
- expansion of guided day hiking
- the ability for some activities to include short hikes in their itinerary
- increased opportunities to offer guided winter activities (beyond those offered by GSI)
- more flexibility in where guided wilderness groups can go
- increased shuttle services within the park

Among the new opportunities offered by Alternatives 2- 4 are:

- Step- on Guides
- Camp Muir winter guides (winter Muir Route non- summit experiences)
- Art and Photography classes
- Westside Road Shuttle and bike tours and other
- Shuttles (recurring and reservations only).

Collectively, these expanded and new opportunities would result in the same effects as noted above for new commercial services, with many visitors taking advantage of them, and others avoiding them.

- Because most of the new or expanded activities would occur within areas already experiencing visitor use,
- because there would be a greater degree of control over commercial activities than over the same array of independent activities, and
- because the expansion of commercial services opportunities would allow park resource protection messages to reach more people,

collectively, there would be a minor to moderate short- term adverse effects, that when detected by monitoring would cease through enforcement of permit conditions. As a result, there would be cumulative minor long- term beneficial effects on most visitors' experiences.

New Commercial Services Evaluation Process: This process would take into account potential impacts on a variety of park resources would be used, replacing the case- by- case analysis of new services that would now occur, in absence of the moratorium, and which would continue to occur in Alternative 1. This new process would result in better, more systematic evaluation and monitoring of services and therefore better commercial services for park visitors. Under Alternatives 2- 4 there would be increased flexibility to avoid some inappropriate commercial activities, resulting in a long- term negligible to moderate beneficial effect on park resources and therefore on visitor experience, especially enjoyment.

Muir Winter Guides: Adding Muir Winter Guides in Alternatives 2- 4 would facilitate more non-summit winter mountaineering experiences, an expanded winter visitor use opportunity that would have a negligible effect on increasing visitor access.

Increased Shuttle Services: Increasing the number of shuttle services and adding new shuttle services on the Westside Road would result in a long- term beneficial effect on visitor access as well as visitor use opportunities by:

- increasing access to the west side of the park,
- increasing access to some areas where parking lots fill,
- increasing the flexibility for visitors to hike one- way trails without a car shuttle
- limiting the impact of commercial use visitors on independent visitor parking and
- encouraging some visitors to leave their cars behind.

At the same time, some visitors used to experiencing the west side of the park with fewer trail or road companions, and visitors who felt the park was already too crowded would be less supportive of shuttles that might bring more visitors or might increase use of some more remote areas. This would result in a concurrent short- term adverse effect as some visitors reacted to the

change, and a potential minor long- term adverse effect in increasing crowding of this area of the park that has been difficult to access for some time.

An increase in shuttles could also result in bringing more visitors to areas where access was previously limited by the size of the parking area. This could result in a moderate adverse effect on visitor access on some trails, with some overcrowding on popular trails or in popular areas. These effects could be limited by the future Carrying Capacity Plan called for by the GMP.

Increased Towing Services: Increasing the number of towing services with CUAs would result in faster, more efficient calls for towing services for park visitors, a negligible to minor long- term beneficial impact.

Conclusion: There would be no impairment of visitor experience access and enjoyment from the implementation of Alternatives 1- 4.

➢ WILDERNESS

Discussion

Section 4 (c) of the Wilderness Act prohibits certain activities in wilderness by the public, but at the same time allows agencies to engage in these activities in some situations:

> "except as necessary to meet minimum requirements for the administration of the area for the purpose of this Act (including measures required in emergencies involving the health and safety of persons within the area), there shall be no temporary road, no use of motor vehicles, motorized equipment or motorboats, no landing of aircraft, no other form of mechanical transport, and no structure or installation within any such area."

As a result, the NPS is required to apply a minimum requirement analysis" to all decisions concerning management of the wilderness area (National Park Service Director's Order 41: Wilderness Management, Arthur Carhart National Wilderness Training Center 2002). Consideration must include: 1) whether the project or activity is necessary to meet the minimum requirements for the administration of the area and 2) which tool or method, that results in the least impact to the physical resource or wilderness values, should be used to complete the project.

Management Policies further directs the NPS by stating:

> If a compromise of wilderness resource or character is unavoidable, only those actions that preserve wilderness character and/or have localized short- term adverse impacts will be acceptable (NPS Management Policies 2001:6.3.5)."

For the purposes of this programmatic assessment actions called for in this Commercial Services Plan are evaluated against the following wilderness management factors, including maintaining:

- primeval character and influences or "naturalness"
- opportunities for solitude
- opportunities for primitive, unconfined recreation and physical and mental challenge
- opportunities for scientific study, education, stimulation, inspiration
- cultural resources values.

For analyses, evaluation of the following additional factors has been considered for their impacts on wilderness values:

- operating requirements;
- maintenance requirements;
- standards and designs;
- mitigation measures; and
- monitoring and feedback.

Most minimum tool analyses related to this plan have been conducted previously, or would be conducted as part of future implementation of specific actions called for by this plan. As specific

actions are proposed in wilderness, the park's environmental analysis process, coupled with specific analysis of the proposed minimum tool would continue to be used and would include analysis of the effects on a variety of wilderness values. Some specific actions that would occur, however, are described broadly below to aid in a better understanding of the effects of this plan on wilderness.

The following actions proposed by the action Alternatives in this Commercial Services Plan have the potential to affect wilderness:

- adopting a park commercial services plan
- continuing to conduct SAR operations throughout the park, and resupply and human waste management helicopter operations (to non wilderness camps surrounded by wilderness)
- continuing to maintain two non- wilderness high camps surrounded by wilderness
- changing the ratio of commercial to independent park visitors
- adopting a process to determine the need for route marking
- designating more trail segments and wilderness campsites (in sensitive alpine areas)
- implementing the GMP direction for differentiating between high use and moderate use climbing routes

As evaluated below and in other sections above as well as in the Wilderness Management Plan (NPS 1989), these actions are necessary to administer park wilderness and have varying effects on wilderness quality.

Similar to Alternative 1, adhering to Wilderness Management Plan goals and limits and reevaluating them when necessary would help to avoid, minimize or mitigate wilderness impacts.

By the same token, the following strategies to avoid, minimize or mitigate wilderness impacts would be used in Alternatives 2- 4:

- limiting commercial groups to one in any one camp or zone at the same time and spending only one night in any one camp or zone (except on the Muir, Emmons and Kautz Routes)
- requiring park permit holders and contractors to use and teach minimum impact techniques, such as Leave No Trace, as appropriate
- defining group sizes and upper limits for commercial activities, including day use activities
- requiring the use of blue bags by commercial groups in winter and during high elevation travel
- *requiring commercial groups on non- primary routes to carry out their blue bags*
- limiting commercial group use on summer weekends in some areas
- including analysis of wilderness impacts in the new process for analyzing new commercial services
- requiring commercial groups to utilize standard approach routes, where designated trails are absent
- locating larger, repeated commercial mountaineering day school groups in non- wilderness areas
- limiting cross- country travel by large groups to winter

In addition, there are a variety of actions specific to the alternatives that would reduce the impacts of commercial use on park wilderness. These include the designation of some commercial free areas in wilderness, as well as restrictions on weekend use on some trails, routes or camps. Eliminating weekend use of some popular overnight camps and eliminating some commercial use of climbing routes altogether would have a negligible to moderate effect on the visitor experience. Alternatives 2- 4 would also result in changes in commercial visitor use patterns and in commercial visitor travel to and from the park. Under these alternatives, the requirement for commercial services to shuttle their clients within the park would result in fewer commercial vehicles at popular and other trailheads and parking areas. Other specifics related to individual alternatives are described below.

❖ Primeval Character and Influence/"Naturalness"

Wilderness Primeval Character Impacts of Guided Climbing, Wilderness, Alpine Wilderness and Additional Services Alternative 1

Park wilderness management would continue to focus on maintaining natural processes through better understanding of long- term ecological components, systems and processes, including the effect of human influences. There would be no effect on the primary wilderness mandate to maintain the primeval character and natural influences or "naturalness" of park wilderness lands. As appropriate the maintenance or restoration of natural processes would continue to predominate in park wilderness management actions and goals.

The park would continue to maintain two non wilderness climbing high camps surrounded by wilderness. As a result, in this and other alternatives, the perception of wilderness in the vicinity of these camps would continue to be modified by an array of historic and non- historic and permanent and temporary structures and a much higher density of both commercial and independent day and overnight public use.

The park would continue to conduct Search and Rescue (SAR) operations and training, high camp resupply and rehabilitation, and human waste removal helicopter operations. These operations are critical to managing park wilderness impacts (such as human waste) and users (such as injured climbers), as well as for maintaining non wilderness outposts at Camp Muir and Camp Schurman (as shelter during bad weather, historic structures, and to contact climbing parties). Maintaining these operations would continue to affect not only the perception of wilderness as being influenced primarily by the forces of nature, but also wilderness values such solitude and the maintenance of a primitive, unconfined recreational experience. Helicopter resupply and human waste flights would continue to be conducted outside of the primary visitor use season in the spring and fall for 1- 2 weeks depending on weather conditions and need. SAR operations would continue to be conducted as needed throughout the year. Human waste barrel placement and removal operations (as discussed in Water Quality) are also conducted in the spring and fall in conjunction with the high camp resupply operations and other non- routine project flight operations. The use of helicopters in wilderness to conduct these operations has been established as the minimum tool and would continue to have a moderate, short- term localized adverse impact on wilderness values.

The same degree of route marking, designated wilderness campsites and other route finding devices would remain in park wilderness. The same hierarchy of designated and way trails would also remain. The high use climbing zone (Muir Route) concession- maintained climbing devices (such as crevasse ladders, fixed lines and others) would also be permitted to remain. The Muir Route concessioner would also continue to be permitted to "shovel out" the route over the season, thus designating this route on the upper mountain. The use of temporary wands and portable ladders by both independent and commercial park visitors would remain a permitted activity as defined in the Wilderness Management Plan and their removal would continue to be required on the return trip. The same informal process to request the use of short- or long- term climbing devices would also continue to be used by the Muir Route concessioner. On other routes, including the Emmons, Kautz and Other the use of fixed climbing devices would continue to be prohibited and would continue to be removed upon discovery.

Conclusion: While long- term wilderness management goals would prevail, Alternative 1 would continue to have short- term localized adverse impacts as well as long- term negligible to minor adverse effects on wilderness values as a result of ongoing resource protection and visitor use management in park wilderness. No impairment of the primeval character of wilderness would occur.

Wilderness Primeval Character General Impacts of Guided Climbing, Wilderness and Alpine Wilderness Alternatives 2-4

The park would adopt a more formal process to review proposals to determine the need for climbing route marking and other route improvements. This process would be documented by

more specific environmental analysis to determine the minimum requirement, and/or minimum tool. If necessary, programmatic environmental analysis would cover a range of acceptable specific actions. Adoption of this process would result in a minor beneficial effect on maintaining wilderness character and the expectation of a primitive, unconfined recreational experience.

Conclusion: In addition to the effects of Alternative 1, Alternatives 2- 4 would result in a long-term minor beneficial effect on the primeval character of wilderness. No impairment of the primeval character of wilderness would occur.

❖ Opportunities for Solitude

Wilderness Solitude General Impacts of Guided Climbing, Wilderness and Alpine Wilderness Alternative 1

As defined in the park GMP (NPS 2001), the Muir Routes would remain a high- use climbing route and the Emmons and Kautz Routes would remain moderate use climbing routes, while all other climbing routes and other park wilderness, without designated trails, would retain a pristine or primitive designation. Wilderness trails would continue to be semi- primitive, transition or unmaintained (within primitive or pristine zones).

Initially, these alternatives would have the least impact on increasing the number of wilderness visitors, since the 2001 array of commercial operations is different than that proposed in other alternatives. As the moratorium was lifted, however, there would be a rise in the approval of applications for park commercial services, including approval of different types of services since there would be fewer means of limiting increases in commercial business operations. Consequently, compared to other alternatives, Alternative 1 would have the highest potential maximum summer and annual use in guided climbing, guided wilderness and guided alpine wilderness as well as in guided day use. This would result in more people in more commercial groups on more trails and climbing routes throughout the park, limited only by existing or future changes to overnight use limits.

This would have a moderate impact on both independent day use visitors' and overnight wilderness visitors' experience of solitude with more people encountering commercial groups (of up to 12 people) in wilderness. Specific differences associated with the alternatives are described below.

Climbing Alternative 1: With the implementation of this alternative, there would be no effect on the experience of the high- use climbing zone (Muir Route) identified in the GMP: "A moderate to high degree of social interaction and few opportunities for solitude." On the Muir Route in summer, there would continue to be little opportunity for solitude, with daily approaches by concession clients (up to 59 per night) combined with daily approaches by similar number of independent overnight climbers and day use visitors. On moderate use climbing routes (Emmons and Kautz) under this alternative, there would be no effect on the experience of solitude defined by the GMP for the Kautz Route (since the concessioner would continue to run climbs on this route similar to those now offered). On the Emmons Route, however, there would be a potential for an increased number of CUAs to be issued that could result in use approaching or becoming nearly the same as that on the Muir Route. The moderate use climbing zone experience is defined as a "moderate to low degree of social interaction and more opportunities for solitude." As a result, under this alternative, there could be a moderate to major adverse impact on wilderness solitude, particularly on the Emmons Route in summer. Due to the difficulty in accessing other climbing routes, the mostly longer approaches required and the limited number of spaces available for overnight camping, it is not likely that a major increase in the number of CUAs would result in crowding on these routes under this Alternative.

Wilderness, Alpine Wilderness and Additional Services Alternative 1: Compared to existing independent use, there would be a negligible to moderate effect, depending on the trail segment in question associated with the definition of semi- primitive or transition trails. While semi-primitive trails would continue to have a "wilderness experience with occasional periods of

solitude" and transition trails would continue to have a "wilderness hiking experience with a high degree of social interaction and few opportunities for solitude," there would be a possibility that without limits identified by a Carrying Capacity Plan that the number of day use CUAs issued could result in modifying some semi- primitive trails to transition trails. This possibility would potentially be greatest along the Westside Road where greater access could result in other easily accessible trails becoming transition trails over time due to a major increase in the number of CUAs being issued. This impact, while it could occur over time, would not be expected to occur during the expected life of the Commercial Services Plan. Upon future updates, monitoring information would be available and if a change in the zone definition was found, actions could be taken to reduce the impact.

Conclusion: These alternatives would result in a moderate impact on day and overnight wilderness visitor solitude in some areas. There would be no impairment of wilderness solitude.

Wilderness Solitude General Impacts of Guided Climbing, Wilderness and Alpine Wilderness Alternatives 2-4

These alternatives would offer the same maximum potential use for a variety of primarily day use commercial services, although as noted above, there would be differences among these alternatives in the number of people in overnight commercial groups using wilderness. In general, opportunities for solitude would continue to be greatest away from the high- use nonwilderness and developed areas and in the absence of guided group experiences. With slight overall annual visitation increases combined with the varying levels of commercial use set by the alternatives in this plan, the effect of even increased commercial use (in some activities) would result in minimal effects on the visitor experience since commercial use constitutes only a small percentage of total use.

Wilderness Solitude Impacts of Guided Climbing Alternatives 2-4

The greatest appearance of commercial use would continue to be on climbing routes, where the technical and physical challenge of climbing the lower forty- eight's fifth highest, largest and most heavily glaciated peak draws a large number of visitors, without basic climbing skills. Even so, the minor changes would occur on the Muir Route and moderate to major changes in commercial use would occur on the Emmons and Kautz Routes. These changes however, would be in conformance with the definitions of high and moderate use climbing routes as noted above and described in the GMP and below.

Aside from Alternative 1, Climbing Alternative 2 would result in the greatest potential increase in wilderness use and would therefore likely result in the highest number of commercial wilderness encounters (a measure of how often other people are seen in wilderness). By the same token, Climbing Alternative 4 would result in the lowest level of encounters. Because of the reduction in the number of areas available to commercially guided climbers on Other Routes in Alternatives 3 and 4, there would be an expected reduction in the number of encounters related to commercial climbing on Other Routes in these alternatives. That reduction would comparatively be greatest in Alternative 3 and least in Alternative 4 since there are more restrictions in Alternative 3.

Measured in user nights, the greatest number of commercial (and independent) user nights would continue to be on the Muir Route in all alternatives, followed by the Emmons and Kautz Routes in Alternatives 2 and 3 and by the Emmons Route then the Kautz Route in Alternative 4. As in Alternative 1, Other Routes would continue to have the fewest wilderness encounters due to their greater degree of difficulty and risk. Regardless of the increases proposed in Alternatives 2, 3 and 4, in summer Alternative 1 would continue to have a moderate to major adverse impact on wilderness solitude on the Muir Route and would have the greatest impact, albeit negligible to minor during most of the year increasing to minor to moderate during the peak season, on other routes as well. By comparison, Alternatives 2, 3 and 4 would have moderate impacts, although encounter levels in Alternative 4 would be greatly reduced over Alternatives 2 and 3 on the Muir, Kautz and Other routes, although increased on the Emmons. Because the number of guided climbers is high on the major climbing routes (approximately 50 percent of total use on the Muir Route), and because there would be regularly occurring commercial use of the major climbing routes the contribution of commercial use to wilderness solitude would remain high, but

generally lower than independent use on climbing routes. It would be potentially highest in Alternative 1, where it could continue to could increase over time (it has taken approximately 13 years for guided concession climbing to double on the Muir Route) – see Table 8.

Wilderness Solitude Impact of Guided Wilderness Alternatives 2-4
Aside from Wilderness Alternative 1, Wilderness Alternative 2 would also result in the greatest number of commercial wilderness encounters, while Wilderness Alternatives 3 and 4 would be similar, with fewer guided wilderness visitors proposed in Alternative 3, however when user nights are compared, the greatest number of commercial encounters would likely be in Alternative 2, followed by Alternative 4, with Alternative 3 trailing behind. Because the number of commercially guided wilderness visitors would remain small in all action alternatives, and because the number of independent wilderness visitors is much higher, the contribution of commercial use to overall wilderness encounters would be small. There would be no effect on the definition of solitude for the wilderness management zones identified in the GMP.

Wilderness Solitude Impact of Alpine Guided Wilderness Alternatives 2-4
The alternatives are similar with respect to both total use and user nights, although Alternatives 2 and 4 would have the fewest encounters, followed by Alternative 3. These experiences would occur on glaciers identified as a GMP primitive zone, where there would be "Opportunities to experience solitude and quiet. Visitors would feel apart from other people but not entirely alone." With fewer than 300 commercial visitor experiences per year, there would be a negligible effect on the sense of wilderness solitude. During most of the year opportunities for solitude would continue to meet this definition. Compared to Alternative 1, there would be more opportunities for wilderness solitude in these alternatives.

Conclusion: Increased numbers of guided wilderness visitors in Alternatives 2- 4 would have fewer opportunities for solitude, resulting in a minor adverse impact. Overall, however the increases in commercial use associated with these alternatives would have a negligible to moderate effect on opportunities for solitude, which would still continue to be abundant during winter and in non-peak seasons. There would be no impairment of wilderness solitude under Alternatives 2- 4.

Wilderness Solitude Impacts of Additional Services Alternative 2
Compared to the current types of activities in no action alternatives (1), the number of commercially guided activities would increase in Alternatives 2- 4 and there would be fewer opportunities for visitors in these groups to experience wilderness solitude. This would have a negligible to minor adverse effect on the small overall number of visitors who choose to participate in guided wilderness activities. Except for peak season trips and climbs on primary trails and routes, as a group and in winter, other visitors would continue to have abundant opportunities to experience wilderness solitude.

For the most part, this alternative would not result in changes to the GMP wilderness management zone definitions of solitude, however there could be minor to moderate changes associated with use of the Westside Road with shuttle establishment. Greater access would likely result in other easily accessible trails becoming transition trails over time due to the increased access provided by shuttles to the many loop trail opportunities along the Westside Road.

❖ Opportunities for Primitive, Unconfined Recreation, Physical and Mental Challenge

Wilderness Primitive Unconfined Recreation Impacts of Guided Climbing, Wilderness, Alpine Wilderness and Additional Services Alternatives 1
The park would continue to offer outstanding opportunities for primitive, unconfined recreation and physical and mental challenge under any alternative. The unique climbing opportunities, expansive wilderness opportunities and diversity of topography and vegetation would be unchanged. Although the park contains hundreds of miles of designated trails, there are many more opportunities for cross- country routes and new climbing routes continue to be attempted

each year. With wilderness occurring within approximately 200 feet of developed areas, there are a variety of opportunities for wilderness visitors of all abilities.

Conclusion: There would be no effect and no impairment of opportunities for primitive, unconfined recreation and physical and mental challenge in Alternative 1.

Wilderness Primitive Unconfined Recreation Impacts of Guided Climbing, Wilderness, Alpine Wilderness Alternatives 2-4 and Additional Services Alternative 2
The following actions called for by Alternatives 2- 4 would result in impacts on the wilderness value of maintaining opportunities for primitive, unconfined recreation and physical and mental challenge:

- requiring concession and CUA climbing groups to use established access approaches to access climbing routes, especially in snow- free alpine areas;
- limiting cross- country travel to small groups in summer and permitting large and small groups in winter
- designating more trail segments in sensitive alpine areas
- designating more wilderness campsites as needed.

These strategies would limit guided group opportunities for a more primitive, unconfined recreational experience, but would benefit other wilderness values by better protecting vegetation, soils and other resources. Because guided groups naturally have a more confined experience, these effects would be negligible. Consequently, these actions would collectively have a negligible to minor beneficial impact on wilderness resources, while having a negligible adverse effect on the wilderness experience of some commercial groups and other wilderness visitors by adding to the collection of marked routes within the park.

In winter, there would continue to be outstanding opportunities for primitive, unconfined recreation. Although some commercial activities would be focused in winter and some traditional summer focused activities would be encouraged to occur throughout the year, most commercial activity, particularly most guided climbing would continue to be done during the appropriate season – summer. Therefore coupled with the above effects in summer, there would be a negligible adverse effect in winter.

Conclusion: The changes in commercial activity called for by this plan would individually and collectively have a minor to moderate beneficial effect on a primitive unconfined recreational experience in summer combined with a negligible adverse effect on the wilderness experience of commercial visitors and a negligible adverse effect in winter, depending on the activity in question. There would be no impairment of this wilderness value under the implementation of any of these alternatives.

❖ Opportunities for Scientific Study, Education, Stimulation, Inspiration

Wilderness Scientific Study Impacts of Guided Climbing, Wilderness, Alpine Wilderness and Additional Services Alternative 1
The alternatives in this plan would have no effect and no impairment on opportunities in wilderness for scientific study. Alternative 1 would also have no effect or impairment on wilderness opportunities for education, stimulation and inspiration.

Wilderness Scientific Study Impacts of Guided Climbing, Wilderness and Alpine Wilderness Alternatives 2-4 and Additional Services Alternative 2
These alternatives contain a suite of options for a variety of commercial services, some of which would expand opportunities for education, stimulation and inspiration, including summer guided day hiking, guided winter activities and step- on guides. Collectively these new opportunities, as well as the existing array of commercial services opportunities, would be subject to an array of new requirements. These would include more guide orientation in the NPS mission and policy, minimum impact techniques, and a variety of other requirements that would increase the ability of guides to provide better information to their clients. As a result, there would be a minor to

moderate expansion in opportunities for commercial visitors to learn more about the park. The provision of new and expanded opportunities under these alternatives would also increase the ability of park commercial visitors to be stimulated and inspired.

Conclusion: There would be a minor to moderate beneficial effect on opportunities for scientific study, education, stimulation and inspiration. No impairment would result.

❖ Cultural Resources Values

Wilderness Cultural Resources Values Impacts of Climbing, Wilderness, Alpine Wilderness and Additional Services Alternative 1
There would be no additional impacts or impairment of cultural resources values in wilderness from the implementation of this alternative.

Wilderness Cultural Resources Values Impacts of Climbing, Wilderness, and Alpine Wilderness Alternatives 2-4 and Additional Services Alternative 2
These alternatives would result in the same, minimal impacts to wilderness cultural resources values. There would be no adverse effect on cultural resources values in wilderness. Park wilderness cultural resources values would continue to be preserved and rehabilitated. The park would continue to have a goal of maintaining historic structures in wilderness in good condition or rehabilitating these structures to provide for modifications in future use. Wilderness visitors would continue to observe and use historic structures in wilderness, including trails. Other specific actions, such as the rehabilitation of the Westside Road for shuttle use would also result in no adverse effect on cultural resources values. There would continue to be a minor to moderate beneficial impact on park wilderness cultural resources values.

Conclusion: The minor to moderate beneficial impact on park wilderness cultural resources and values would not result in impairment of these resources.

➢ PARK OPERATIONS

Park Operations Impacts of Guided Climbing, Wilderness, Alpine Wilderness and Additional Services Alternative 1
Administering concessions contracts would continue to require analysis of compliance with operating plans for insurance, franchise fees, rate approval, facility improvement programs, financial reporting and other requirements. It would also continue to include operational compliance, including facility inspections, dispute resolution, increasing synchronicity of concessions with park management goals and other tasks.

Administering permits would continue to include analysis or verification of insurance, business licenses, compliance with past permits, financial requirement analysis, and permit issuance. Other administrative tasks include communicating with potential and current commercial services providers.

The current concessions management office staffing would continue to include one full and one part time staff member who would monitor three concession authorizations and 25 IBPs. As the number of CUAs grew under this alternative, more staff would be required to administer, monitor and evaluate concessions contracts and permits. The concessions office also relies on field staff in other park divisions to monitor resource impacts. Formal systems exist to monitor overnight climbing activities and overnight wilderness use. Under existing regulations, the NPS may recover some administrative and monitoring fees from IBP holders. Monitoring for concessions contracts currently comes from park base operations funds. Under the 1998 Concessions Management Act, franchise fees may be used for certain projects and for seasonal or temporary staff. Under current regulations, while monitoring may be charged against administrative costs for permits, there are other restrictions on how that money may be spent for other associated concessions and permit management administration and concessions staff would soon become

overwhelmed under ongoing increases in issuance of CUAs. This would result in a long- term minor to moderate adverse impact on park operations, as the number of permits continued to grow, but time or staff allotted did not.

Increased use in guided climbing, guided wilderness and guided alpine wilderness could also have an effect on the number of independent overnight camping permits that would be available, resulting in a negligible to moderate effect on park operations in managing the distribution of these permits.

Staff from the concessions office and other park staff complete a formal evaluation process for concessions. Services are periodically inspected and evaluated. This includes the concessioners' compliance with the contract and with annual operating plans. Unsatisfactory annual ratings can result in termination, although the process is far from simple. IBPs are evaluated on a pass/fail basis. Companies found to be in violation of permit terms may have their permits revoked through a simple process, but may reapply for permits in future years. In 2001, concessions staff conducted 59 operations inspections. Reviews of the IBP operations conducted by other divisions were reported to the concessions office. There would continue to be annual operating and maintenance plan reviews and modifications.

The concessions staff currently offers training to park staff who will be evaluating IBP and concession activities prior to the beginning of the primary visitor use season. Introductory training sessions regarding the NPS mission are also offered to concession staff. There is currently no training offered to IBPs or other commercial services providers.

The current climbing concessioner is able to purchase time for helicopter materials deliveries to Camp Muir and has dedicated use of several structures at Camp Muir (see *Cultural Resources* section above). The current food and gift services concessioner also has dedicated use of several structures, plus partial use or management of other structures. For housing GSI uses Glacier Dorm and several buildings at Longmire, including L (Longmire) - 125, L- 126, L- 140, L- 141, and L110. GSI also manages the National Park Inn, the Paradise Inn, and spaces in the Paradise Jackson Visitor Center, Sunrise Lodge and a mobile food service vehicle.

Conclusion: There would be a minor to moderate adverse effect on park operations as a result of increasing the number of CUAs managed. No impairment of park operations would result.

Park Operations Impacts of Guided Climbing, Wilderness, Alpine Wilderness Alternatives 2-4 and Additional Services Alternative 2

Under these alternatives, there would be more administration, monitoring and evaluation needs associated with managing a wide variety of new and modified park commercial services. There would be more commercial services operations to administer, monitor and evaluate. There would also be a new commercial services evaluation process to administer and a new selection process to administer if more requests than could be accommodated were received for CUAs. There would also be increased revenue to manage coming from the new CUA opportunities and concessions (see *Visitor Experience* above).

Concessions and other park staff would have more responsibilities in monitoring CUAs and concessions, in revising annual operating and maintenance agreements, in monitoring the reporting of use, processing complaints, tracking administrative and permit requirements that would vary among activities, conducting lotteries, giving training and in processing proposals for new commercial services.

More administration, monitoring and evaluation needs would require more staff time, both in the concessions office and from other park staff. To the degree that these additional responsibilities could be funded by revenue from permits and concessions, they would have a long- term beneficial effect on park operations. To the degree that the park needed to perform more responsibilities and additional time or staffing were not allocated, this would continue to erode

current responsibilities and would result in a long- term minor to moderate adverse effect on park operations.

Because limits for new and old commercial services are defined in these alternatives and therefore the long- term costs associated with the management of these services are known, there would be a long- term minor beneficial effect on park operations. This effect would not occur in Alternative 1, where the number of permits issued would be greatly increased for some activities.

Establishing minimum guide to client ratios for a variety of activities would have a negligible to minor effect on increasing public safety for guided clients. This would result in a similar effect on park operations, perhaps contributing to better training of clients and potentially fewer needs for assistance. By the same token, limiting commercial groups to established approach routes for climbing would minimize the need for park staff monitors to search for the approach route used. Allotting commercial spaces for overnight use ahead of the primary season (and then releasing unused spaces to the non- guided public) would also minimize the potential for conflicts between the guided and non- guided public. These actions would result in a minor beneficial effect on park operations.

Additional Park Operations Impacts of Guided Climbing Alternatives 2-4

As increases in use of the Emmons Route occurred under these Alternatives, there would be an increased need for more NPS presence on the east side of the park to monitor and evaluate the new concession operations. This need would be greatest in Alternative 3, where there would be the most concession operations, and least in Alternatives 2 and 4 where there would be fewer operations. Additional use of the Emmons Route would also increase the need for a second toilet at Camp Schurman, where the one now present is inadequate to handle even current use on some weekends and holidays. More storage space to ensure adequate preparation for rescues and other emergencies would also be necessary. As at Camp Muir, concessioners would perhaps request storage space for some rescue and other emergency gear not generally needed on climbs. Locating a new toilet and perhaps new storage would result in a both a long- term minor beneficial and adverse effect. These structures would increase the number of high elevation structures in the park with ongoing maintenance needs. They would also increase visibility of the non- wilderness outpost at Camp Schurman however they would also facilitate park human waste and management of Search and Rescue operations.

Increasing guided climbing use on the east side could also change park priorities for snow plowing, resulting in either a longer season or more defined opening and closing dates to accommodate the needs of concession advertised trips. This could result in a long- term negligible to minor adverse effect on park operations, depending on snow conditions during spring opening and or fall closure of the White River Road.

Additional Park Operations Impacts of Additional Services Alternative 2

The new commercial services evaluation process would result in a more systematic evaluation of new commercial services than now occurs under Alternative 1. This evaluation process is more consistent with resource management objectives defined in the park General Management Plan and along with the definition of necessary and appropriate activities eliminates some latitude in the approval of new commercial services. This would have a moderate long- term beneficial effect on park resources, by adding more comprehensive evaluation of the effects of new services on a host of park resources, including vegetation and visitor experience.

Conclusion: Alternatives 2- 4 would have both long- term negligible to moderate beneficial effects and long- term negligible to moderate adverse effects.

➢ SOCIOECONOMIC ENVIRONMENT

Discussion

Each of the Alternatives within this Environmental Assessment would result in some economic gain for the park and/or commercial service providers. Price Waterhouse Coopers prepared an economic analysis of the financial viability of the climbing alternatives for the park to ensure that these would meet the definition of commercial viability as concessions. While no professional analysis of the wilderness, alpine wilderness or other commercial services was made, the following assessment is based on park experience with Incidental Business Permits and on analysis of the potential new regulations relating to Commercial Use Authorizations. While there is no minimum requirement for attaining financial viability for CUAs, there is a minimum requirement for financial viability associated with concessions. There is also a maximum financial gain associated with CUAs of $25,000 each business (within the park) per year.

Socioeconomic Impacts of Guided Climbing, Wilderness, Alpine Wilderness, and Additional Services Alternative 1

The total gross annual income for current park commercial services is approximately $10,203,000. 2001 concessioner gross revenues for the hospitality contract have hovered around $7.0 million annually, while revenue from guided mountaineering is approximately $3.0 million. Firewood sales generally gross around $15,000. Revenues derived from IBPs are generally not audited, but were around $200,000 in 2001.

Socioeconomic Impacts of Guided Climbing Alternatives 2-4

Pricewaterhouse Coopers, LLC, studied the proposed action climbing alternatives (2- 4) to provide feedback on the economic viability of the alternatives. Based on potential net income, the figure that can provide a basis for determining the level of a franchise fee, Alternative 3 would potentially provide the highest fee to the park. Net income derived from Alternatives 2- 4 would be substantially lower overall, resulting in a potentially reduced franchise fee for the park. The differences in potential net income result from the parameters guiding the alternatives, and in Alternative 4, from the level of service that can be provided. According to the Pricewaterhouse Coopers economic analysis, Alternative 3 would result in the greatest economic return for the park, since due to increased competition, climbs would be more likely to reach expected capacity. Alternative 3 would have both the greatest degree of climbing revenue and the greatest net economic feasibility (including return to the park). Alternative 2 would result in the next greatest degree of revenue, but the least economic feasibility and Alternative 4 the least revenue, but the middle range of economic feasibility.

Socioeconomic Impacts of Guided Wilderness and Guided Alpine Wilderness Alternatives 2-4

Compared to 2001, under alternatives 3 and 4, there would be slightly more revenue generated as a result of Wilderness CUAS with slight increases in the number of people and user nights. Alternative 2 would more than quadruple the number of people that experienced guided wilderness trips in 2001. Alternatives 2, 3 and 4, would, however be likely to generate many fewer wilderness trips and participants than the potential available in Alternative 1 with the moratorium lifted. Guided Alpine Wilderness Alternatives 2, 3 and 4 would result in approximately the same economic impacts, with only approximately one- third more people and user nights as occurred in 2001 projected.

Socioeconomic Additional Services Alternative 2

This alternative would result in a diversified array of modified, existing and expanded commercial services that would collectively result in increased revenue to the park that would be commensurate with the management needs associated with these services. CUAs, which are authorized under the 1998 Concessions Act, allow for the recovery of costs, including at a minimum, associated management and administrative costs. While CUAs provide, by definition, incidental and/or minimal business opportunities, they could also offer a variety of local employment opportunities to individuals in gateway communities and beyond. Waiving permit

fees for towing operators would result in a negligible economic benefit on a small number of these businesses who would likely provide these services in the park.

VI. CUMULATIVE IMPACTS

Because the subject of this Environmental Assessment is the comprehensive management of commercial services in the park there are few additional cumulative impacts that have not been addressed within the individual subject areas. As described below, however, one connected action and one area plan could result in additional impacts.

The Camp Muir Development Concept Plan, mentioned in earlier analyses has the potential to both increase short- term impacts related to construction at Camp Muir and to decrease long-term impacts related to visitor use and incremental historic structure rehabilitation. Though the individual components of this plan are not fully developed, at a minimum it would result in rehabilitation of existing facilities at Camp Muir and at a maximum, it could result in a variety of new facilities that would better protect Camp Muir and the surrounding area from ongoing impacts related to visitor and administrative use.

The Mount Rainier Resort at Park Junction, which when built out would dramatically increase the population of the upper Nisqually River Valley could result in more demand for commercial visitor services and a potential for increased visitation during the winter, as well as during the summer. Under current plans, resort visitors would primarily be shuttled to the park and would arrive mostly during non- peak times.

While, for the most part in the foregoing impact analyses, the impacts of the climbing, wilderness, alpine wilderness and additional services alternatives have been discussed individually, in many cases, they have been combined as well. The preferred set of alternatives identified (Climbing Alternative 3, Wilderness Alternative 3, Alpine Wilderness Alternative 2 and Additional Services Alternative 2 would result in the same range of impacts on most resources, individually and cumulatively because these activities, for the most part, occur in different areas. Where they do overlap, however, overnight activities would continue to be limited by Wilderness Management Plan established overnight use limits so that the potential overlap that exists in Alternative 2 Climbing as it pertains to the Emmons Route would not increase the number of people that might be at the Glacier Basin Wilderness Camp. Common to all alternatives is a prohibition on more than one commercial group in any one camp (except Camps Muir, Schurman and Hazard) at one time that would prevent most combined effects of allowing overlapping commercial use of the same areas.

VII. CONSULTATION AND COORDINATION

This Environmental Assessment and the accompanying Commercial Services Plan are available for a **ninety- day** public review period from August 2003 to November 2003 (the exact dates will be determined by the document printing date). At that time, a press release will be distributed to people and businesses who have expressed an interest in the Commercial Services Plan. The press release will also be mailed to a list of persons and agencies that have expressed interest in Mount Rainier National Park proposed actions and events. Included will be organizations such as The Wilderness Society, Sierra Club, The Mountaineers, Mount Rainier National Park Associates, etc. The complete Plan/Environmental Assessment will be mailed to local libraries, organizations and individuals that have requested to receive a copy of the Commercial Services Plan and others who request copies during the review period. The Commercial Services Plan and Environmental Assessment will also be available on the park's website, located at http://www.nps.gov/mora.html.

Comments on the Commercial Services Plan and/or Environmental Assessment should be directed to:
Superintendent
Mount Rainier National Park
Tahoma Woods, Star Route
Ashford, Washington 98304

If reviewers do not identify substantial environmental impacts, this Environmental Assessment will be used to prepare a Finding of No Significant Impact (FONSI), which will be sent to the Regional Director of the Pacific West Region for signature.

For more information concerning this Environmental Assessment, please contact Concessions Management Analyst, Christopher Jones at 360- 569- 2211, ext. 2303 (general), Steve Klump at extension 3304 (wilderness), Mike Gauthier at extension 3305 (climbing) or Environmental Protection Specialist, Rose Rumball- Petre at (360) 569- 2211, extension 3376. For a copy of this document, please call Mount Rainier National Park at (360) 569- 2211, extension 2301.

The following people and agencies were consulted during the preparation of this Environmental Assessment:

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Summary of Public Involvement
Newsletters (3)
Public Meetings (5 scoping, 4 public review)
Consultation with SHPO (ongoing)
Consultation with Tribes (ongoing)
Consultation with USFWS/NMFS (ongoing)
Summary of Public Comments

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Appendix 1

Mitigating Human Impacts to Vegetation

Signs

A series of studies in the Paradise Meadows (Johnson and Swearingen 1986, Swearingen and Johnson 1988, Johnson and Swearingen 1982) evaluating the effectiveness of signs and other strategies in decreasing minor rule violations, especially minimizing off- trail use, found that a trail side sign threatening a fine was about twice as effective as a cluster of the following three signs:

- "Stay on the Paved Trails and Preserve the Meadow"
- "Do Not Tread, Mosey, Hop, Trample, Step, Plod, Tip Toe, Trot, Traipse, Meander, Creep, Prance, Amble, Jog, Trudge, March, Stomp, Toddle, Jump, Stumble, Trod, Sprint or Walk on the Plants"
- Symbolic red circle cross hatch over hikers profile with the message " No Off- Trail Hiking"

And, the above signs were significantly more effective than

- "No Hiking – Meadow Repairs"

In the presence of the most effective sign 1.8 percent of visitors continued to walk off- trail. Finally, the presence of a uniformed park employee at or near the observation site eliminated off-trail hiking altogether (Johnson *et al.* 1994).

ALPINE VEGETATION IMPACTS STUDIES IN MOUNT RAINIER NATIONAL PARK EDWARDS 1977-1980

Edwards 1977

Talus findings
- Damage occurred primarily due to scrambling primarily by dayhikers
- *Senecio fremontii* and *Oxyria digyna* were only found in the zero impact condition class
- Dominant species *Polemonium elegans* and *Smelowskia ovalis* often protected from direct damage by habitat preference – crevices between stones (unless stones were dislodged)

Fellfield findings
- Eastern ridge more plant species
- Bare areas colonized slowly from edges
- *Lupinus lepidus* was the only species that re- colonized the bare sandy eroded centers
- Trampling accelerates erosion by breaking away moss margins of hummock terraces
- Most obvious damage is from stone moving for campsite construction

Heath-sedge findings
- Decrease in species and canopy cover as impact increases
- Several species subject to trampling damage
- Wet sites subject to compaction and had higher impact levels

Snowbed findings
- Possible for high use to cause few impacts due to low plant density
- Roots extend far beyond visible plant
- Walking over loose sandy- gravel soil has greater impacts than more stable soils
- Most species associated with stones (removal or movement lethal)
- No evidence of regeneration of *Saxifraga tolmei* following trampling

Edwards 1980

General findings
- species are distributed along moraines and cleavers and fragmented into subpopulations separated by masses of glaciers and snowfields
- topography, elevational range and aspect of each cleaver is unique, with corresponding differences in number, extent and variety of plant communities
- The two areas that support the most varied communities (including substrate and species diversity) are also the two most easily accessible and frequented by climbers:
- "None of the remaining approach routes, confined as they are to steeper, narrower ridges, pass through areas of great floristic density, extent or diversity such as are found on the Muir and Schurman routes.
- It is probably not a coincidence that the less steep and easier routes favored by visitors are also favorable to many more plant species" (Edwards 1980:32).
- other approaches more remote, with fewer visitors, smaller parties and less disturbance
- some damage occurs on cleaver ridges in late summer when snow or ice travel is not an option
- where established trails exist and camping restricted, fewer impacts are evident with current use levels because plants are protected elsewhere by adjacent steep and unstable terrain

Muir Route findings
- Study of other summit approach routes confirmed significance of some areas of Muir Route (sedge- turf terraces are found nowhere else)
- Panorama Point- Moon Rocks fellfields comprise a special and extensive plant community
- No rare species between 9,000 and 10,000 feet on Muir Route
- Cathedral Rocks – highest elevation for flowering plants *Draba aureola*

Schurman Route findings (A more complete report is contained in Edwards 1977b.)
- Wedge support a richly diverse assemblage of subalpine and alpine plants
- Mount Ruth has more varied communities and more plant species than any other alpine area on Mount Rainier

- Mount Ruth particularly unstable and easily eroded when dislodge
- Unique fellfield terraces (bands of vegetation alternating with stripes of bare sandy soil overlain by pumice mulch) occur at about 7,00 feet near the main ridge
- Camp Curtis marks convergence of Inter Glacier and Mount Ruth routes and includes the beehive and upper and lower Camp Curtis and contains more than 20 platforms – disrupting past and future plant habitat

Van Trump Park – Camp Hazard (Kautz Route) findings

- very little alpine vegetation above Van Trump Park (not comparable to Muir Corridor)
- snowfields broken up by generally barren moraines, colonized sparsely and by few species
- westerly ridge near Wilson Glacier has dense population of *Polemonium elegans*
- high camps cause minimal ecological disturbance

More information about other routes is contained in the same report. Highlights follow:

- Success Cleaver: Pyramid Peak fellfields are compared to what Panorama Point must have looked like before they experience severe usage
- Puyallup Cleaver: mature heather meadows, though less extensive and lower in elevation than Muir and Mount Ruth
- Ptarmigan Ridge: alpine desert at camp area, sparse vegetation well- protected by obvious route
- Lower Curtis Ridge: windswept, *Silene suksdorfii* (found here and 2 other cleavers – considered rare)

Edwards 1985

This study established permanent plots and associated line and quadrat (plot) transects as well as campsite surveys to monitor vegetation conditions along the Muir Route. The following visual condition classes were used: no impact, very little change, discernible change, definite change, severe change, drastic change, catastrophic change and habitat destroyed (Edwards 1985:11- 12).

Behavior and Characteristic Use Patterns of Visitor Groups on Muir Route (Edwards 1977:51-53 and 1980:22-25)

Skiers and snowshoers

- considerable activity in early spring when islands of fellfields are exposed – exposed vegetation brittle, ground frozen,
- visitors attracted to exposed areas, concentrated damage in earliest emerging areas, especially Panorama Point- McClure Rock

Picnickers

- meander widely or sit on vegetation – damage most intense in immediate vicinity of Panorama Point,
- on- trail and off- trail damage includes generating rock movement, trampling

Day Hikers

- will follow trails where these are obvious
- typically avoid snowfield and make their way along rock ridges, wandering cross- country over fellfields
- typically have light footwear and pack loads
- use snow free areas immediately adjacent to snowfield

Climbers

- generally traverse snowfield, some damage evident at Pebble Creek, west rock ridge waterfall area and Cathedral Rocks rest stops
- heavier boots and laden packs cause greater impacts than lighter shoes worn by others, as a result cross- country travel accentuates alteration to substrate and vegetation
- established routes difficult to follow because of uneven snowmelt

Campers

- activity probably causes more habitat and substrate alteration in the alpine zone than all other visitor activities combined with the single exception of heather meadow trampling at Panorama Point (Edwards 1980:24)
- occurs primarily in fellfield areas
- causes desertification of fellfields or loss of substrate through erosion

Appendix 2

Minimum Requirement/ Minimum Tool Analysis

Minimum Requirement and Minimum Tool analyses are completed by the park's wilderness coordinator. In most cases, an analysis is initiated through the completion of the park's Proposal, Planning and Review form. Specific questions are asked about a proposed project to determine how that project fits within overall park and wilderness management goals. A section of the form seeks information about the minimum tool required, including the use of mechanized equipment and helicopters.

An interdisciplinary team then reviews the Project Proposal, Planning and Review (PPR) form with the project initiator in a meeting format. Several factors are included in the review including:

1. Project Description – What does the project involve, is it necessary, and where will it occur?
2. Wilderness Management – Are the proposed actions at the minimum level necessary to solve the problem and meet wilderness management objectives?
3. Timing and Occurrence –This section reviews the effect of the project's timing and the frequency that the project's tasks will occur.
4. Use and Duration of Mechanized Equipment – What mechanized equipment is proposed for use during the project and how long will it need to be used?
5. Ability to do Without Mechanized Equipment – Are there alternatives to using mechanized equipment? What is the cost comparison between using mechanized and non- mechanized methods?

The PPR process is the first step in determining the level of environmental compliance that may be required for a project. Depending on the scope of the project and the results of the interdisciplinary team's review, an environmental assessment or environmental impact statement may be necessary.

A Minimum Tool justification form (WMP 1992) and/or Aircraft Use Request form (A- 70) are used for routine (non- project based) work which may require the one- time use of mechanized equipment or helicopters in wilderness. These forms require the work leader and wilderness coordinator to articulate why mechanized equipment is necessary and the effects on wilderness values if mechanized equipment is used. After the document has been reviewed by the wilderness coordinator, it is forwarded to park management for approval or disapproval.